



2040 Bend Metropolitan Transportation Plan

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Executive Summary

Introduction

Transportation is a key contributor to the Bend area's quality of life and economic viability. As the region continues to grow, additional demands are put on the transportation system. With limited resources, determining the best means for improving the system and meeting future demand is challenging. The Bend Metropolitan Planning Organization (BMPO) is responsible for developing the Bend Metropolitan Area's long range transportation plan to provide guidance on how future local, state, and federal transportation dollars are spent. This document, the 2040 Bend Metropolitan Transportation Plan (MTP) summarizes the outcomes of the planning and community dialogue that occurred to develop transportation priorities and goals for the year 2040 planning horizon. In collaboration with local land use and community planning efforts, the Bend MPO provides a forum for local elected officials and transportation and land use experts to work together to improve the area's transportation system for residents, business, and visitors. The organization will update this plan at least every five years to meet federal and state requirements and to reflect local goals, priorities, and objectives. This executive summary provides an overview of the conclusions and recommendations of the most recent update to the 2040 Bend Metropolitan Transportation Plan.

Figure EX-1 shows the Bend MPO area and major transportation facilities within the MPO.

Overview of the MTP

The Metropolitan Transportation Plan is a multi-modal transportation plan designed to meet the anticipated 25-year transportation needs within the BMPO planning area boundary. The plan is a guide for the management of existing transportation facilities and for the design and implementation of future transportation facilities through the year 2040. It looks at how all the pieces should fit together and what other opportunities are available for a coordinated and contiguous system. The roadway element of the plan is emphasized in recognition that automobiles and trucks are the predominant mode of transportation today; however, the roadway element also plans for connectivity to other modes of travel. The roadway system provides for bicycle travel through the addition of upgraded urban streets with sidewalks and bike lanes or other provisions for safe bike travel. Throughout the urban area, bicycle facilities and sidewalks are proposed for accessible and safe pedestrian and bicycle travel. In many cases, there are transit needs within the improvements designated for roadway improvements. All of these factors are critical when describing the transportation system. Other elements of the plan cover important aspects of the overall system including transportation system management (TSM), transportation demand management (TDM), freight, and safety.



Figure
EX-1

A significant requirement of the MTP is that it must be financially constrained. The MTP must identify projects and recommended policies that can be implemented within the current funding trends of the metropolitan area. Ultimately, a 2040 financially constrained transportation system improvement strategy was developed to meet the transportation needs of the metropolitan area. The transportation system improvement strategy was reviewed by the Technical Advisory Committee and Policy Board.

Planning Process

Regular updates of the MTP are important to conform with state and federal requirements; to reflect changes to the MPO's transportation network, existing and planned future land uses; to update socioeconomic characteristics that have occurred in recent years. Updates are also important to integrate other recently completed planning efforts into the MTP.

The 2014-2040 MTP represents Stage I of a two stage update process. Stage I provides an update of the prior plan based on a new 2040 land use scenario and an updated 2040 revenue forecast. It is expected that the land use patterns within the MPO (which is a fundamental assumption that drives transportation needs) will be revised in the next few years as part of the City of Bend's current Urban Growth Boundary update efforts. Once that process is complete and a new future land use pattern and UGB boundary is established, a comprehensive Stage II update of the BMPO's MTP will be completed to be consistent with those new land use plans. The timing of the two staged MTP update process can be summarized as follows:

- Stage I (May to September 2014)
 - Plan update based on using a new 2040 land use scenario in the current Bend MPO travel demand model (planning year 2040)
 - Incorporate recently completed planning efforts and available data
 - Prepare an updated revenue forecast and financial plan
 - Conform with federal requirements to maintain federal status and funding
- Stage II (to begin early 2015)
 - Update the planning land use scenario based on outcomes of other Bend area planning efforts (such as the Bend UGB Remand process)
 - Reassess the findings and projects outlined in Phase I based on the new Redmond-Bend regional travel demand model that is currently being developed and make updates as needed
 - Update the MTP for additional MAP-21 requirements as they become clear
 - Address additional concepts desired by the partnering agencies such as Alternate Mobility Standards and a more in depth evaluation of the needs of US97 (Parkway) and US20 in the BMPO area (see Chapter 21 – Outstanding issues for more specifics)

As with any regional effort, the update to the BMPO MTP occurred with significant collaboration and input from invested stakeholders and partnering agencies. The agency and stakeholder involvement for this process used a Project Management Team, the BMPO Technical Advisory Committee (TAC), and the BMPO Policy Board to facilitate communication, support informed decision-making, and gain meaningful “buy-in” from all parties. Additional input was also sought from other groups or organizations as needed through the process.

Goals and Objectives

The Goals and Objectives for the Bend MPO area reflect the transportation priorities of the jurisdictions within the MPO, the goals established by the state of Oregon and the guidelines set by the Federal Government for metropolitan regions. The Goals and Objectives set the tone and guide the development and selection of transportation solutions for the MTP. The Goals and Objectives also serve to guide implementation of the MTP. The current MTP Goals and Objectives were adopted in July 2006. They have not specifically been revised as part of this 2014 update effort as they are still relevant and reflective of community values. As the MTP is updated in the future, the goals and objectives will be reviewed to assure that they reflect current regional priorities for the MTP as well as federal direction and requirements. The regional transportation goals adopted as part of the MTP are:

- **Mobility and Balance**
 - Goal 1: Provide a variety of practical and convenient means to move people and goods to, from and within the MPO area.
 - Goal 2: Develop a transportation system that serves the needs of all travel modes, provides intermodal connectivity, and provides a range of transportation options throughout the MPO area.
- **Safety and Efficiency**
 - Goal 1: Address traffic congestion and problem areas by evaluating the broadest range of transportation solutions.
 - Goal 2: Serve the existing, proposed and future land uses with an efficient and safe transportation network.
 - Goal 3: Design and construct the transportation system to enhance safety for all modes.
- **Accessibility and Equity**
 - Goal 1: Provide people of all income levels with a wide range of travel options within the MPO area.
 - Goal 2: Support all Americans with Disabilities Act (ADA) requirements and policies
- **Land Use**
 - Goal 1: Integrate land use and transportation by encouraging land use patterns that provide efficient, compact uses of land that facilitate a reduced number and length of trips.
 - Goal 2: Promote development patterns that preserve the life of the existing transportation system.
 - Goal 3: Promote development that does not rely on primary access to the state transportation system.

- **Environment and Livability**
 - Goal 1: Recognize and respect the natural and historical features over which transportation improvements pass to minimize adverse impacts.
 - Goal 2: Design transportation improvements that protect the environment by preserving air and water quality, minimizing noise impacts and encouraging energy conservation.
 - Goal 3: Use context sensitive design principles when designing and locating transportation facilities.
- **Economic Development**
 - Goal 1: Implement transportation improvements that foster economic development and business vitality.
 - Goal 2: Develop a transportation network with transportation options that enhance linkages between centers of employment, education, medical facilities and neighborhoods.
 - Goal 3: Recognize the importance of intermodal connections and maintain adaptable approaches to trends and opportunities that enhance intermodal connections.
- **Financially Responsible**
 - Goal 1: Coordinate and design transportation improvements to assure the expenditure of resources in the most cost-effective manner.
 - Goal 2: Maximize the ability to leverage alternative and multiple funding sources for transportation system improvements.

Additional detail regarding the regional transportation goals and their associated objectives can be found in Chapter 4 of the MTP.

Land Use Forecast 2010-2040

The Bend area has experienced cycles of slow and fast growth in population over the past decades. During the 1970s, the population in Bend grew by almost 26 percent, while growth slowed somewhat in the 1980s. The 1990s saw another population surge that continued into the first half of the 2000s. The area was hard hit by the Great Recession, but recent trends indicate that significant growth could occur again in the future. Future population and employment forecasts are key components in the evaluation of land use, transportation, infrastructure, and other needs. Forecasts are only as good as the data and assumptions upon which they are based and require updates as new information becomes available.

The population of the Bend area is expected to increase by nearly 40% over the next 18-20 years and nearly 70% in the next 25-30 years. This increase in population will have a significant impact on the transportation system. The transportation needs of the population, however, will be changing as well. An aging population will be more reliant on alternative modes of transportation. At the same time, the rapid growth of the Internet and other technologies may affect travel patterns and behavior. Therefore, not only is the amount of growth important, but also the forecast characteristics of the population. Based on these trends, the Bend Metropolitan Planning Organization (BMPO) and the City of Bend made population forecasts for 2040. By 2040, the

population is expected to grow to 140,861 persons within the Bend UGB (up from 76,639 in 2010 [Census]).

Growth in total employment within the Bend urbanized area is forecast to increase steadily over the next 30 years. Much of this growth is expected to occur in the trade and service sectors. The highest growth in employment is expected in Transportation, Communications, Utilities sector and in the Construction industry. Overall, employment with the BMPO area is expected to grow from 40,763 jobs in 2010 to 80,783 jobs by 2040. Additional details regarding the land use forecast developed for this plan can be found in Chapter 5 of the MTP.

Again, it is important to note that the land use patterns within the MPO (which is a fundamental assumption that drives transportation needs) will be revised in the next few years as part of the City of Bend's current Urban Growth Boundary update efforts. Once that effort is complete and a new future land use pattern and UGB boundary is established, a comprehensive Stage II update of the BMPO's MTP will be completed to be consistent with those new land use plans. The land use forecast developed as part of this planning effort were for the purposes of development of the MTP and are not intended to serve as estimates of the outcome of the UGB boundary assessment.

Transportation Revenue

The rules of the Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) require the MTP to be "fiscally constrained," meaning that the cost of projects included in the MTP cannot exceed the capacity of the region to fund the projects. As such, an analysis of funding resources that the BMPO can reasonably expect to fund projects and to support operations and maintenance of the transportation system was completed focused on estimating revenues that will be available over the next 25 years for transportation improvements in the region. The transportation "needs" in a region almost always exceeds the financial resources considered reasonably available to pay for projects. For these reasons, the biggest and defining task of a metropolitan transportation plan is to select and prioritize projects within the constraint of available funding. The remaining needs with the region are termed illustrative and can be included in the fiscally constrained set of projects if new funding sources are found.

Projects to improve the transportation system are funded through a mix of federal, state, and local revenues distributed through a variety of funding programs that dictate how this revenue can be spent. In addition to revenue generation and spending by multiple jurisdictions, revenue sharing among jurisdictions and cooperation among multiple jurisdictions on individual projects makes describing transportation funding complicated. The key agencies that spend money towards transportation projects in the BMPO are the Oregon Department of Transportation, Deschutes County, the City of Bend, and Cascades East Transit. The revenue forecast for the 2040 MTP was developed by reviewing the historical budgets and existing financial forecasts from these agencies. In addition, other data and advice from staff at involved jurisdictions was incorporated as

needed. Finally, draft version of the regional revenue forecast were reviewed and refined by agencies staff experts and the BMPO TAC throughout the plan development.

The resultant 2040 transportation revenue forecast for the BMPO is summarized in Table EX-1.

Table EX-1: Bend MPO 2040 Revenue Forecast*

	City of Bend	ODOT	Deschutes County	Total
Total Resources	\$219,970,000	\$32,593,000	\$--	\$252,563,000
<i>Projects not in MTP</i>				
SDC local improvements	\$65,000,000	\$--	\$--	\$65,000,000
<i>Projects in MTP</i>				
ITS	\$5,000,000	\$7,000,000	\$--	\$12,000,000
Safety	\$3,000,000	\$1,000,000	\$--	\$4,000,000
Stand Alone Bike/Ped	\$15,000,000	\$--	\$--	\$15,000,000
Roadway	\$131,970,000	\$24,593,000	\$--	\$156,563,000
Subtotal (all projects in MTP)	\$154,970,000	\$32,593,000	\$--	\$187,563,000

*Note all numbers rounded to the nearest \$1,000

As shown in Table EX-1, there is approximately \$187,000,000 in transportation revenue forecast available to for regional projects within the BMPO area over the 2040 planning horizon (excluding transit). Chapter 19 of the MTP provides a detailed summary of the anticipated transportation funding available and the revenue analysis completed for this plan update.

Financially Constrained Transportation Projects

Combining the future transportation needs assessment with the 2040 revenue forecast, the planning process worked through a process to develop a financially constrained project list consisting of those projects prioritized to be funded over the planning horizon.

Roadway Projects

Table EX-2 outlines the financially constrained roadway project list for the 2040 Bend MTP.

Table EX-2: Financially Constrained / Preferred Scenario Roadway Project List

Project #	Location (Jurisdiction)	From	To	Improvement	Project Priority	Planning Level Cost (\$1,000s)
1	Reed Market Rd	15 th Street	27 th Street	3 lane collector modernization with bike lanes and sidewalks	Short	Funded
2	Reed Market Rd	15 th Street		Intersection Improvement – will convert from signal to partial multi-lane roundabout	Short	Funded
3	Reed Market Rd	American Lane		Re-align American Lane (straighten road and add traffic signal at Reed Market intersection)	Short	Funded
4	Reed Market Rd	4 th Street	15 th Street	3 lane collector modernization with bike lanes and sidewalks	Short	Funded
5	Murphy Rd Phase 1			Various roadway and interchange improvements	Short	Funded (under construction)
6	New E-W Collector	Brosterhous Rd	American Lane	New 2 lane road	Short	Funded
Total Short-Term Project Cost (projects 1-6): Funded						
7	Empire Avenue	3 rd Street	Highway 97 NB ramps	Widen to 5 lanes and install signal at SB ramps	Long	\$3,900
8	Empire Avenue	Purcell Boulevard	27 th Street	Construct 2 lane extension	Long	\$6,700
9	Reed Market Road (Bend)	27 th Street Intersection		Re-align Stevens Road to connect directly to Reed Market Road	Long	\$4,700
10	O.B. Riley Road	Empire Avenue Intersection		Construct intersection control improvements	Long	\$1,900
11	Murphy Road	Brosterhous Road	15 th Street	Construct 2 lane extension	Long	\$11,375
12	Highway 97/Cooley Road area improvements	Cooley Road		Various intersection and lane upgrade improvements	Long	\$30,000
13	Empire Ave (Bend)	NB off-ramp		Widen existing ramp to 2 lanes	Long	\$3,000
14	Highway 97	Powers Road Intersection		Preliminary engineering and ROW acquisition for overcrossing or interchange	Long	\$6,500
15	Highway 20 (Greenwood Avenue)	4 th Street Intersection		Install traffic signal	Long	\$413
16	Yeoman Road	18 th Street	Existing section	Construct 2 lane extension	Long	\$1,009

Project #	Location (Jurisdiction)	From	To	Improvement	Project Priority	Planning Level Cost (\$1,000s)
17	North frontage road	Murphy Road	Powers Road	New 2 lane road	Long	\$5,400
18	South frontage road	Murphy Road	Parkway off-ramp	New 2 lane road	Long	\$13,800
19	Britta Street (north section)	Robal Road	Empire Avenue	New 2 lane road extension	Long	\$1,000
20	Britta Street	Ellie Lane	Halfway Road	New 2 lane road extension	Long	\$2,000
21	Purcell Boulevard	Holiday Ave (south)	Holida Avenue (north)	New 2 lane road extension	Long	\$2,288
22	Mervin Samples Road – Sherman Road	O.B. Riley Road	Empire Avenue	Upgrade to 2 lane collector roadway and install traffic signal at Highway 20	Long	\$6,100
23	O.B. Riley Road	Glen Vista Road	Archie Briggs Road	Upgrade to 3 lane arterial	Long	\$6,700
24	27 th Street	Bear Creek Road	Ferguson Road	Upgrade to 3 lane arterial	Long	\$11,500
25	Highway 97	Murphy Road		Construct northbound on and southbound off ramps	Long	\$6,100
26	18 th Street	Cooley Road	Empire Avenue	Complete 3 lane arterial corridor	Long	\$6,100
42	Highway 20	Cooley Road		Construct intersection control improvements	Long	\$1,600
45	Highway 20	Cooley Road	3 rd Street	Add second southbound through lane	Long	\$4,800
46				Other future local transportation projects	Long	\$19,687
Total Long-Term Project Cost (projects 7-26):						\$156,563
						TOTAL COST: \$156,563

**The project cost estimates include right-of-way costs.*

Although the majority of projects included within this plan have funding sources, some additional projects are identified that go beyond the immediate availability of known funding trends. These projects (“Illustrative Plan”) address capacity and connectivity issues that were not addressed in the Financially Constrained Scenario. The designation and inclusion of these extra projects are important to future planning efforts, as they allow right-of-way needs to be preserved and allow opportunities for new funding that becomes available to be applied to projects that have been already been identified as addressing future deficiencies in the regional transportation network.

Tables EX-3 and EX-4 outline the illustrative (unfunded) roadway projects for State and City/County roadways respectively.

Table EX-3: Illustrative Project List for State Facilities

Project Description	Limits	Estimated Cost
US 97 Bend North Corridor Improvements	Bend Northern UGB to Empire Avenue	\$120-\$180 million
Highway 97 Corridor Improvements	Empire Avenue to Colorado Avenue	Unknown
Highway 20 Corridor Improvements	3rd Street to 27th Street	Unknown
Highway 20 North Corridor Improvements	Tumalo Road to Empire Avenue	Unknown

Table EX-4: Additional Illustrative Projects

Project #	Location (Jurisdiction)	From	To	Improvement	Estimated Cost (\$1,000s)
27	Cooley Road	18 th Street	Deschutes Market Road	Construct 3 lane road extension	\$11,867
28	Hunnell Road	Cooley Road	Rodgers Road	Construct new 2 lane road	\$8,000
29	Yeoman Road	Deschutes Market Road	Butler Market Road	Construct 2 lane road extension	\$1,688
30	South frontage road	Ponderosa Street	Baker Road	Construct new 2 lane road	Unknown
31	Murphy Road	15 th Street	Rickard Road	Construct new 2 lane road extension	Unknown
32	Cooley Road	O.B. Riley Road	O.B. Riley Road	New 2 lane road loop extension	\$10,863
33	Putnam Road/Tumalo Road	City UGB	Johnson Market Road	Construct new 2 lane road	Unknown
34	Skyline Ranch Road	Shevlin Park Road	Skyliners Road	Construct new 2 lane road	\$11,000
35	Summit Drive	Mt Washington Drive	Skyline Ranch Road	Construct new 2 lane road	\$5,000
39	New E-W collector	27 th Street	Hamby Road	Construct new 2 lane road	Unknown
40	Central Area MMA Improvements			Intersection control improvements and local street network enhancements	Unknown
41	Colorado	Highway 97 Parkway NB Ramps		Construct intersection control improvements	\$3,400
43	Purcell	Cooley	Yeoman	Construct 2 lane road	\$4,731

Project #	Location (Jurisdiction)	From	To	Improvement	Estimated Cost (\$1,000s)
44	Boulevard Robal Road	Road Highway 97 (Parkway) intersection	Road	extension High capacity intersection improvement	\$4,800
47	Highway 97	Powers Road Intersection		Complete construction of interchange or overcrossing	\$13,500

Additional detail regarding the roadway evaluation and project lists can be found in Chapter 6 of the MTP.

Pedestrian & Bicycle Projects

Pedestrian and bicycle facilities are integral elements of the transportation system and valuable components in the strategy to reduce reliance on automobiles. The community benefits in many ways from adequate pedestrian and bicycle facilities including reducing traffic congestion, supporting tourism, improving public health, and providing accessibility to all parts of the community. Pedestrian and bicycle amenities will be included with construction of new roadway projects and along with modernization of existing roadways. Beyond this, there is \$15,000,000 in standalone pedestrian and bicycle projects that have been included in the financially constrained MTP. The majority of these have been identified through previous planning efforts as part of the City's Transportation System Plan as well as the on-going *Strategic Implementation Plan for Walking and Biking Infrastructure* plan.

Additional details regarding the pedestrian and bicycle elements of the MTP can be found in Chapter 7 of the plan.

Public Transit Improvements

The financially constrained project list includes improvements to the public transportation system. Public transportation is an important element of multi-modal transportation planning and provides mobility options for the traveling public. Providing transportation options is important for all people and it is essential for those who are unable to drive motor vehicles. Three recent studies have identified issues and strategies toward improving transit services in Central Oregon:

- BMPO Public Transit Plan and Corridor Land Use Assessment (PTP)
- Central Oregon Regional Transit Master Plan (RTMP)
- Central Oregon Strategic Transportation Options Plan (COTOP)

The PTP serves as the Public Transit Plan for the Bend Metropolitan Planning Organization (BMPO) and is incorporated as the public transportation component of the Bend MTP. The PTP identifies a robust plan for the CET transit system including short-term, mid-term, and long-term improvements. Improvements are identified for service quality and non-service elements such as facilities, amenities, access, and marketing.

The following summarizes the timeline and key developments for PTP's proposed service concepts:

- Short-term (Years 1 to 3): Address the most pressing operational issues; including enabling Route 5 (Wells Acres) to run within a 40-minute schedule all day by restructuring it to interline with Route 6 (Bear Creek).
- Near Mid-Term (Year 4): Routing modifications for Route 3 (Newport to COCC) and Route 11 (Galveston), with additional service on Route 11 to support the planned OSU facility on SW Century Drive. Also, one additional evening run should be provided on all routes, extending service until nearly 7:00 p.m. on weekdays. Stop infrastructure would be required for the proposed route redesigns.
- Mid-Term (Years 5 to 10): An initial implementation of the restructured system, providing more frequent service (every 30 minutes) for several routes on primary transit corridors. Other routes with less demand would run hourly. Users could make transfers more easily and the system would be more flexible and scalable over time. Several routes would be modified and a new route (Greenwood to Forum Shopping Center and St. Charles Medical Center) would be added. Transit service hours would be expanded to early evenings on weekdays (until 8 p.m.) Two additional vehicles would be required along with stop infrastructure related to route redesign.
- Long-Term (up to 20 years). A set of flexible service options can be implemented in phases, linked to available funding and criteria for service expansion. The concepts include expanding service hours on weekdays and Saturdays, implementing Sunday services, and expanding service in NE and SE Bend, if warranted by development characteristics in those areas. Significant operating and capital improvement funds would be needed for the proposed increases in frequency and additional routes.

Additional details regarding future public transportation improvements can be found in Chapter 8 of the MTP and the BMPO Public Transit Plan and Corridor Land Use Assessment study.

Transportation Safety Projects

This transportation safety element of the MTP identifies programs and plans directed at improving transportation safety in the MPO region and outline strategies the MPO can undertake. Several agencies at the federal and state level have developed plans and corresponding strategies that address the safety of their transportation facilities. These plans stress the importance of building, maintaining, and operating a transportation system that is safe for all users. In addition, the Bend MPO has set goals and policies that emphasize the importance of building, maintaining and operating a regional transportation system (regardless of mode) that is safe for all users. The goals related to safety help guide the future development of the roadway network, address safety concerns in a range of areas, and select specific projects for construction. Both ODOT and the City of Bend maintain safety management programs to identify safety concerns and prioritize improvements to address those concerns. Based on these on-going

efforts, there is \$4,000,000 in projects included in the financially constrained MTP targeted at safety improvements. Table EX-5 summarizes these projects according to the process that identified them (i.e. ODOT HSIP or City of Bend Multimodal Traffic Safety Program). Note that the ODOT HSIP identifies projects falling into one of three categories:

- Signalized/FYA – Signalized intersection improvements, including flashing yellow arrow (FYA) upgrades where applicable
- Pedestrian – Improvements targeting reduced pedestrian crashes at signalized intersections
- Curve Signage – Improving curve signage and pavement markings

Table EX-5: Safety-Specific Projects in Bend MTP

Location	Description	Estimated Cost
ODOT HSIP Projects		
Reed Market Road: 3 rd St – 27 th Ave	Signalized/FYA	\$52,000
Knott Road/27 th Street: US 97 – Stevens Rd	Curve Signage	\$32,500
3 rd Street: Revere Ave – Murphy Rd	Signalized/FYA	\$156,000
27 th Avenue: Butler Market Rd – Bear Creek Rd	Signalized/FYA	\$130,000
Penn Ave/Neff Rd – 8 th St – Medical Center	Signalized/FYA	\$78,000
Wall St/Bond St – Newport Ave – Idaho Ave	Pedestrian	\$39,000
Wall St/Bond St – Revere Ave – Franklin Ave	Signalized/FYA	\$273,000
<i>ODOT HSIP Total</i>		<i>\$760,500</i>
City of Bend Multimodal Traffic Safety Program Projects		
Bear Creek/Purcell/Pettigrew	Stop Sign Visibility	\$6,820
Country Club/Murphy	Stop Sign Visibility	\$5,390
Powers/3 rd	Signal Modifications, Pedestrian Crossing Improvements	\$65,586
Reed Market Rd/3 rd	Signal Modifications, Pedestrian and Bike Crossing Improvements	\$208,287
Reed Market/27 th	Signal Modifications	\$96,740
Wilson/2 nd	Do Not Block Intersection	\$18,480

Location	Description	Estimated Cost
	Signing and Markings	
Butler/27 th	Signal Modifications, Bike Lane	\$56,570
Division/Revere	Signal Modifications, Road Diet	\$347,687
Bond/Colorado	Signal Modifications	\$55,300
Awbrey/Portland	Mini Roundabout	\$98,883
Brosterhous/3 rd	Signal Modifications	\$69,000
Neff/Purcell	Signal Modifications, Bike Lanes	\$86,590
Franklin/Wall	Signal Modifications, Pedestrian Crossing Improvements, Eliminate Right-turn Lane/Add Parking Spaces	\$56,506
Greenwood/1 st	Road Diet	\$273,867
Greenwood/Hill	Road Diet	\$273,868
3 rd /Franklin	Signal Modifications, Bike Crossing Improvements	\$208,207
Greenwood/Hill	Shared Lane Markings	\$49,166
1 st /Franklin	Road Diet, Bike Crossing Improvements	\$207,531
<i>City of Bend Total</i>		<i>\$3,118,321</i>
<i>Overall Total</i>		<i>\$3,878,821</i>

Conclusions & Outstanding Issues

This MTP update conforms with state and federal requirements; reflects recent changes to the MPO's transportation network; and updates existing and planned future land uses and socioeconomic characteristics that have occurred since the adoption of the previous plan in 2007. It also integrates recently completed regional transit and ITS plans into the MTP. It has produced a new financially constrained project list that is based on updated travel demand projections as well as an updated revenue and financial forecast for what transportation funding is expected to be available over the planning horizon.

Looking forward, it is expected that the land use patterns within the MPO (which is a fundamental assumption that drives transportation needs) will be revised in the next few years as part of the City of Bend's current Urban Growth Boundary update efforts. Once that is complete and a new future land use pattern and UGB boundary is established, a comprehensive update of the BMPO's MTP (Stage II) can be completed to be

consistent with those land use plans, including the Bend Area General Plan and the Bend Transportation System Plan. This effort will also, to the extent possible, incorporate goals of the latest federal transportation bill (MAP-21).

It is expected that the Stage II MTP update will begin in early 2015 and will focus on

- A comprehensive public involvement process that involves a broad range of stakeholders and interested parties.
- Assessing the findings and projects outlined in this Stage I (September 2014) using the new Redmond-Bend regional travel demand model that is currently being developed and make updates as needed
- Updating the MTP for additional MAP-21 requirements as they become clear.
- Addressing additional concepts desired by the partnering agencies such as Alternate Mobility Standards
- An evaluation of the needs of US97 (Parkway) and US20 in the BMPO area.
- Updating the Goals, Objectives, & Performance measures upon which the plan priorities are based.

More details on the outstanding issues identified through this planning effort and anticipated areas of future study can be found in Chapter 21 of the MTP.

Location	Description	Estimated Cost
	Crossing Improvements, Eliminate Right-turn Lane/Add Parking Spaces	
Greenwood/1 st	Road Diet	\$273,867
Greenwood/Hill	Road Diet	\$273,868
3 rd /Franklin	Signal Modifications, Bike Crossing Improvements	\$208,207
Greenwood/Hill	Shared Lane Markings	\$49,166
1 st /Franklin	Road Diet, Bike Crossing Improvements	\$207,531
<i>City of Bend Total</i>		<i>\$3,118,321</i>
<i>Overall Total</i>		<i>\$3,878,821</i>

Conclusions & Outstanding Issues

This MTP update conforms with state and federal requirements; reflects recent changes to the MPO's transportation network; and updates existing and planned future land uses and socioeconomic characteristics that have occurred since the adoption of the previous plan in 2007. It also integrates recently completed regional transit and ITS plans into the MTP. It has produced a new financially constrained project list that is based on updated travel demand projections as well as an updated revenue and financial forecast for what transportation funding is expected to be available over the planning horizon.

Looking forward, it is expected that the land use patterns within the MPO (which is a fundamental assumption that drives transportation needs) will be revised in the next few years as part of the City of Bend's current Urban Growth Boundary update efforts. Once that is complete and a new future land use pattern and UGB boundary is established, a comprehensive update of the BMPO's MTP (Stage II) can be completed to be consistent with those land use plans, including the Bend Area General Plan and the Bend Transportation System Plan. This effort will also, to the extent possible, incorporate goals of the latest federal transportation bill (MAP-21).

It is expected that the Stage II MTP update will begin in early 2015 and will focus on

- A comprehensive public involvement process that involves a broad range of stakeholders and interested parties.
- Assessing the findings and projects outlined in this Stage I (September 2014) using the new Redmond-Bend regional travel demand model that is currently being developed and make updates as needed
- Updating the MTP for additional MAP-21 requirements as they become clear.

- Addressing additional concepts desired by the partnering agencies such as Alternate Mobility Standards
- An evaluation of the needs of US97 (Parkway) and US20 in the BMPO area.
- Updating the Goals, Objectives, & Performance measures upon which the plan priorities are based.

More details on the outstanding issues identified through this planning effort and anticipated areas of future study can be found in Chapter 21 of the MTP.

Chapter 1: Introduction

The Bend Metropolitan Planning Organization

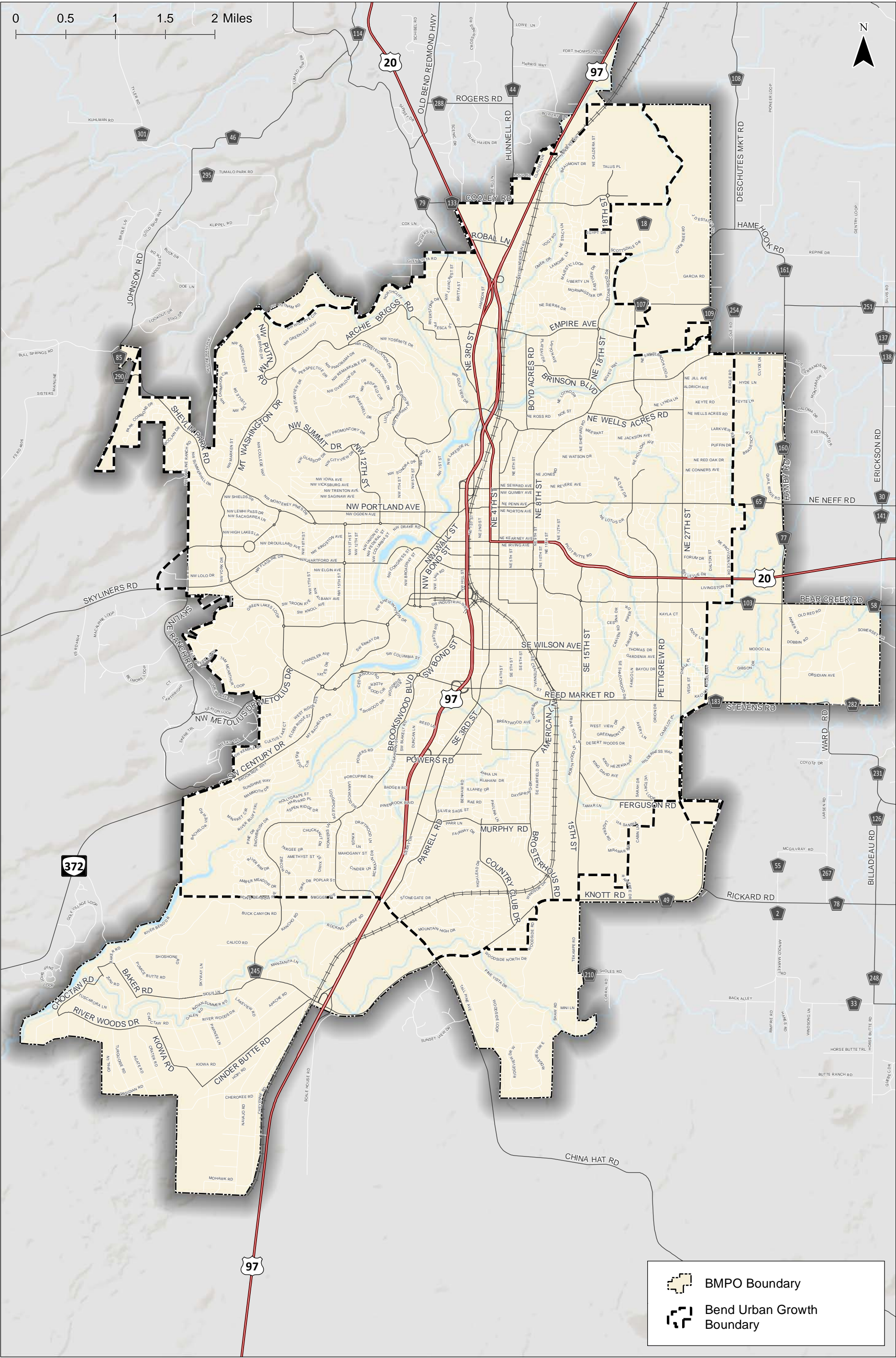
Based on the results of the 2010 US Census, the Bend Urbanized Area exceeded 75,000 in population. Federal regulations (23 CFR part 450) mandate that a Metropolitan Planning Organization (MPO) be designated for areas over 50,000 in population. The primary function of a MPO is to conduct a *continuing, cooperative, and comprehensive* transportation planning process that will result in plans and programs that consider all transportation modes and will support metropolitan community development and social goals. The Bend Metropolitan Planning Organization (BMPO) was designated in December 2002, by the Governor of Oregon. Local jurisdictions involved in the planning activities of the BMPO include the City of Bend and Deschutes County. In addition, the Oregon Department of Transportation, Oregon Department of Land Conservation and Development, Federal Highway Administration, and Federal Transit Administration participate in the MPO process.

The BMPO organizational structure has been designed so that it operates as an entity separate from the participating jurisdictions so that no single entity dominates the organization's decision-making processes. A Policy Board has been established to oversee the process of the BMPO. The Policy Board is comprised of three members of the Bend City Council, one member of the Deschutes County Commission, and an ODOT Region 4 representative. As future major transportation providers form, such as a Transit District, they will be added to the Policy Board. The Policy Board bylaws specify that no decisions shall be made by the BMPO Policy Board without representation from all parties. The bylaws also state that, with the exception of amending the Bylaws, a simple majority of voting members will constitute passage of any action. The voting process may be reviewed annually and will revert to the original voting process unless a consensus of all voting members agrees to the simple majority process. The original voting process stated that all decisions shall be made by consensus. Consensus of the parties refers to consensus among the one ODOT representative, the one Deschutes County representative, and at least two of the three City of Bend representatives. The BMPO planning boundary is shown in Figure 1-1.

Federal and state transportation planning responsibilities for the BMPO can generally be summarized as follows:

- Develop and maintain a Metropolitan Transportation Plan (MTP) and Metropolitan Transportation Improvement Program (MTIP) consistent with state and federal planning requirements.
- Review specific transportation and development proposals for consistency with the MTP.
- Coordinate transportation decisions among local jurisdictions, state agencies, and area transit operators.
- Develop an annual work program (known as the Unified Planning Work Program [UPWP]).
- Maintain the regional travel-demand model for the purposes of assessing, planning, and coordinating regional travel demand impacts. (NOTE: ODOT's Transportation Planning Analysis Unit currently provides modeling support services to the BMPO).

The BMPO entered into an intergovernmental/interagency agreement with the City of Bend establishing the City of Bend as the administrative and fiscal agent for BMPO. This agreement will be reviewed and renewed as appropriate.



Bend Metropolitan Planning Organization Boundary
Bend, Oregon

Figure
1-1

The Importance of Transportation

Transportation is a key contributor to the Bend area's quality of life and economic viability. Generally, the need for transportation stems from our need to access goods, services, and other people within and beyond the region. The ease by which we are able to get from home to school, to a job, to medical services, to shopping and back again is dependent upon the efficiency and effectiveness of the region's transportation system. As the region grows, additional demands are put on the system. With limited resources, determining the best means for improving the system and meeting future demand is challenging. The framework for making decisions on the future of the region's transportation system has become more complex in recent years. Federal, state, and local policy calls for consideration of a wide range of factors in the preparation of a regional transportation plan, including:

- Identifying the means to reduce reliance on the automobile by increasing the transportation choices available in the region,
- Consideration of the interrelationships among the region's land use patterns and transportation system,
- Consideration of the financial, environmental, and neighborhood impacts of future plans, and
- Identifying strategies to maintain and improve the safety of the transportation system.

Ultimately, the most successful transportation plan will be one that enables us to minimize the time and resources required in the future to access the goods and services we need.

Trends and Issues

The region has experienced and is anticipating substantial population and employment growth. From the base year of 2010, the population of the Bend metropolitan area is expected to grow by 70 percent by 2040. Employment in the region is expected to grow by 98 percent during that same period. A forecast of trends during the planning period points to several issues should land use patterns and travel behavior continue as they exist today.

- Congestion would rise dramatically, increasing the cost of travel and reducing the efficiency of the region's roadway network.
- Without a balanced approach to the development of future improvements, little change will be made in the transportation choices available to the region. With little improvement in choices, the proportion of trips using alternative modes will not see significant changes.

Overview of the MTP

The Metropolitan Transportation Plan (MTP) is a multi-modal transportation plan designed to meet the anticipated 20-year transportation needs within the BMPO planning area boundary. The MTP serves as a guide for the management of existing transportation facilities and for the design and implementation of future transportation facilities through the year 2040. The plan is intended to provide the framework and foundation for the transportation future in the metropolitan area. Policies and project descriptions are provided to enable the governments and citizens of the metropolitan area to understand and track projects that will be needed within the next 20 to 25 years. As a plan, this document does not provide designs for individual projects.

Such details are not within the scope of a metropolitan plan and will be completed on a project-by-project basis with the necessary community involvement and environmental analyses.

The MTP provides a coordinated framework for identifying and meeting the regions transportation needs for the next 20-25 years. It provides the best projection for future growth and development based on current trends and approved land uses, policies and ordinances. The MTP looks at the different types of transportation opportunities that are available and what would be beneficial and useful in the future. It looks at how all the pieces should fit together and what other opportunities are available for a coordinated and contiguous system. The plan focuses on intra-regional (within the region) travel, but also addresses inter-regional (through the region) travel. The roadway element of the plan is emphasized in recognition that automobiles and trucks are the predominant mode of transportation today; however, the roadway element also plans for connectivity to other modes of travel. The roadway system provides for bicycle travel through the addition of upgraded urban streets with sidewalks and bike lanes or other provisions for safe bike travel. Throughout the urban area, sidewalks are proposed for accessible and safe pedestrian travel. In many cases, there are transit needs within the improvements designated for roadway improvements. All of these factors are critical when describing the transportation system. Other elements of the plan cover important aspects of the overall system including transportation system management (TSM), transportation demand management (TDM), freight, safety, and security.

The plan identifies the basic assumptions through the year 2040, including forecasts of future population and employment, and the resulting demand on the metropolitan arterial and collector street system. The resulting travel demand was determined through a “best practices” travel demand model. The model is a sophisticated planning tool and will be continually refined and updated to ensure that it serves as an effective tool for future updates. The demographic assumptions used with the model are presented in the Land Use Chapter. Other aspects of the model are described in the technical reports and memoranda summarized in the Appendices.

A significant requirement of the MTP is that it must be financially constrained. The MTP must identify projects and recommended policies that can be implemented within the current funding trends of the metropolitan area. Ultimately, a 2040 financially constrained transportation system improvement strategy was developed to meet the transportation needs of the metropolitan area. The transportation system improvement strategy was reviewed by the Technical Advisory Committee, Citizen Advisory Committee, and Policy Board.

The Technical Advisory Committee and Policy Board met throughout the planning process and reviewed the data, assumptions, and technical work. Much of the final product of the MTP was directed and developed from research and decisions based on these reports and memoranda.

Regulatory Framework

Federal, state, regional, and local requirements comprise the regulatory framework that shapes the Bend area’s transportation planning process. The two most influential pieces of legislation are the federal Moving Ahead for Progress in the 21st Century Act (MAP-21) (successor to the Safe, Accountable, Flexible, Efficient Transportation Equity Act – A Legacy for Users [SAFETEA-LU]) and the Oregon Transportation Planning Rule (TPR). Urbanized areas with a population of 50,000 or more people are required by federal statute to have a regional transportation plan that demonstrates consideration of several factors, such as system preservation and efficiency, energy conservation, and congestion relief.

The plan must be constrained to financial resources reasonably expected to be available. The entire plan provides the overall vision for the Bend region, taking into consideration the needs anticipated because of planned growth. To meet federal and state requirements, the plan includes the present financial capabilities of the region's implementing agencies. Thus, the funded project list contains only those projects within the present financial capabilities of the agencies. The illustrative list identifies projects that are beyond current financial capabilities.

In compliance with provisions in MAP-21 and the TPR, the MTP contains transportation goals and policies. The MTP includes a description of the plan amendment process.

The ongoing nature of regional transportation planning allows the MTP to be a dynamic plan of action for the future transportation system, rather than a static snapshot in time. The range of policies and plan amendment and update processes ensure that the MTP will adapt to meet changing conditions within the region, as well as adapt to residents' changing needs. The plan's implementation and further refinement will continue through the collaborative efforts of citizens and organizations that own, operate, regulate, and use the transportation system.

The MTP is particularly important for guiding transportation public policy and investment decision making over the three- to five-year period following plan adoption, until the next plan update. The federal metropolitan planning regulations require the transportation plan to be reviewed and updated at least every five years.

Prior to this document the Bend MPO MTP was last updated in 2007. It is important to update the MTP at this time to ensure compliance with federal requirements. However, it is expected that the land use patterns within the MPO (which is a fundamental assumption that drives transportation needs) will be revised in the next few years as part of the City of Bend's current Urban Growth Boundary update efforts. Once the update is complete and a new future land use pattern and UGB boundary is established, a comprehensive update of the BMPO's MTP can be completed to be consistent with those land use plans. The current document summarizes a focused update of the 2007 MTP to a new planning horizon year of 2040 to conform with state and federal requirements, reflect changes and work completed since the current plan's adoption, and, to the extent possible, incorporate goals of the latest federal transportation bill (MAP-21).

Completing and adopting the MTP provides the building blocks for a comprehensive guide for the future and allow us to make wise use of limited financial resources. Although this update is focused, it is expected to provide a solid foundation for continuing our transportation system planning. We must use this foundation to strive for the implementation measures that will make a difference for the region as a whole.

Using the MTP

Based on this plan, the member jurisdictions and agencies should integrate the policies and recommendations into their own comprehensive planning documents, incorporate local needs with the pending regional strategies, and coordinate project completion with other affected agencies. The MTP provides support and validation of some of the local transportation needs. It is anticipated that each BMPO member jurisdiction will adopt this MTP and will then tailor its comprehensive plan updates to meet the goals and policies identified in the MTP.

The MTP in the Future

The BMPO Policy Board guides the development, updates, and amendments of the Plan and serves as the coordinating and problem-solving body during the MTP planning processes. The Policy Board is in a position to help as the agencies seek to implement essential MTP provisions and to seek ways to build the projects listed in it. Because of the strong implications for funding our transportation needs, we must ensure this document remains alive and is not just a reference or study. Taking current information and priorities into consideration, this document will be adjusted over time under the guidance of our community leaders.

MTP Update Cycle

At a minimum, the MTP must be reviewed, validated, and updated every five years. Plan updates give the BMPO the opportunity to evaluate past projections for growth and anticipated use of the system. During the plan update process, a comparison of existing land use, recent development trends, and the use of the different modal components of the transportation system will be evaluated. This new data will be used to refine growth projections and determine their implications. This provides a basis on which to modify the plan. These minor changes are essential to protecting the accuracy of the plan. In addition, planning sometimes requires a change of direction, including updated goals, policies, or other fundamentals. Such changes require a more in-depth planning process, and, therefore, constitute a major plan update.

Amendments to the Plan can be made between the five-year updates. Each time a major amendment is made to the MTP, it must go through the rigors of a financial-constraint determination. It is anticipated that only large projects that would conceptually change the MTP would require a plan amendment.

The region also has the Metropolitan Transportation Improvement Program (MTIP) that dovetails with the Statewide Transportation Improvement Program (STIP), which is updated every two to three years. The STIP primarily sets the short-term funding direction for transportation projects using federal and state funds.

The next update to the MTP is expected to be completed after the expansion of the City of Bend Urban Growth Boundary (UGB). The intent is to complete a comprehensive update consistent with the adopted UGB amendment and the related amendments to the Bend Area General Plan and Bend Transportation System Plan. Therefore, this 2014 update is a focused update resulting in an updated Forecast Land Use, Motor Vehicles, Pedestrian & Bicycle System, Public Transportation System, Transportation Safety, Environmental Considerations, Revenue Analysis, and Outstanding Issues Chapters. In addition, the next update will address new planning requirements identified in MAP-21. Several other chapters in the MTP, including Existing Conditions, Travel Demand Management, Truck Freight Systems, Security, Parking, Aviation Systems, Rail Systems, Pipeline Systems, and Performance and Mobility Measures were not updated in this plan; these will be updated during the comprehensive update to follow.

Summary

Change is inevitable. The question is not if growth will occur, or even when it will occur. The question is how best to manage the impact of growth as it happens. Can we progress from potential gridlock toward a systematic and affordable plan to keep people and goods moving efficiently from one place to another? The MTP represents many hours of community, staff, and

elected officials' time. It provides a coordinated, comprehensive look into the future as the area continues to grow.

The Plan takes the ideas, potential growth factors, and the desires from the community and various entities, and provides a sense of structure. The MTP is guide for the Bend Metropolitan Planning Organization. Not just a road and highway plan, the MTP looks at all of the transportation opportunities -cars, buses, bicycles, pedestrian paths, air travel, rail, and various combinations of transportation methods. The MTP is not just a wish list, but instead, it is financially constrained, meaning that the projects proposed can be financed with existing and anticipated resources. Although not all of the needs can be funded, the MTP identifies concerns and projects beyond the immediate availability of known funding trends.

The MTP provides answers and potential solutions, yet places the burden of implementation back into the hands of the community and our elected officials. Individual project designs are left to the respective communities to develop over time according to their needs and opportunities. Policies are identified throughout the plan that address alternative transportation uses, agency coordination, system management, and other transportation related concerns.

Chapter 2: The Planning Process

Introduction

The Bend Metropolitan Planning Organization (BMPO) has prepared this update to the regional long range transportation plan, called the Metropolitan Transportation Plan (MTP), for the Bend Metropolitan Planning Area. This update is important to conform with state and federal requirements; to reflect changes to the MPO's transportation network, existing and planned future land uses, and socioeconomic characteristics that have occurred in recent years. It has also been completed to integrate other recently completed planning efforts such as the regional transit plan and county-wide Intelligent Transportation System (ITS) plan into the MTP.

The 2014-2040 MTP represents Stage I of a two stage update process. Stage I provides an update of the prior plan based on a new 2040 land use scenario and an updated 2040 revenue forecast. It is expected that the land use patterns within the MPO (which is a fundamental assumption that drives transportation needs) will be revised in the next few years as part of the City of Bend's current Urban Growth Boundary update efforts. Once that is complete and a new future land use pattern and UGB boundary is established, a comprehensive Stage II update of the BMPO's MTP will be completed to be consistent with those new land use plans. This effort will be a focused update of the current MTP to conform with state and federal requirements, reflect changes and work completed since the current plan's adoption, and, to the extent possible, incorporate goals of the latest federal transportation bill (MAP-21). This update is critical at this time to maintain federal funding eligibility. The update will plan for a horizon year of 2040.

The timing of the two staged MTP update process can be summarized as follows:

- Stage I (May to September 2014)
 - Plan update based on using a new 2040 land use scenario in the current Bend MPO travel demand model (planning year 2040)
 - Incorporate recently completed planning efforts and available data
 - Prepare an updated revenue forecast and financial plan
 - Conform with federal requirements to maintain federal status and funding
- Stage II (to begin early 2015)
 - Update the planning land use scenario based on outcomes of other Bend area planning efforts (such as the Bend UGB Remand process)
 - Reassess the findings and projects outlined in Phase I based on the new Redmond-Bend regional travel demand model that is currently being developed and make updates as needed
 - Update the MTP for additional MAP-21 requirements as they become clear

- Address additional concepts desired by the partnering agencies such as Alternate Mobility Standards and a more in depth evaluation of the needs of US97 (Parkway) and US20 in the BMPO area (see Chapter 21 – Outstanding issues for more specifics)

Process

Determine Transportation System Plan Requirements

The MTP is designed to meet the requirements of the federal legislation and regulations encompassed in MAP-21. In addition, the regional plan must be consistent with the Oregon Transportation Plan and local community goals and priorities.

Determine Transportation System Needs

Using population and employment forecasts for the year 2040, the travel-forecasting model was used to estimate transportation needs of the Bend metropolitan planning region for a 25+ year horizon. The Forecast Land Use chapter (Chapter 5) summarizes the growth and development assumptions used for the year.

A new “best practices” travel demand model was developed for the MTP. The Transportation Planning and Analysis Unit (TPAU) at ODOT developed the travel demand model with the assistance of BMPO and member agency staff. The model is sophisticated and requires significant data definition and input to produce accurate results.

A travel demand model is a tool that can accurately replicate existing transportation conditions and evaluate a variety of future year scenarios. To replicate base year conditions, the essential transportation inputs include the existing roadway and public transportation networks, recent traffic counts, and current population and employment information. Once this data has been entered and adjusted, the model simulates base year traffic movements within a small percentage of error of those observed.

The next step in the modeling process involves projections for future population distribution, employment locations, and any changes in travel behavior. Using these inputs, the model is able to derive future capacity limitations relative to the current roadway system. Once these deficiencies are identified, potential improvements are evaluated by rerunning the model with the “improved” transportation system. A range of different street networks, expansions of the public transportation network, and different land use scenarios can be tested this way. Although this is greatly over simplified, it demonstrates the usefulness of the model as a tool. Future year traffic projections are based on numerous assumptions about population, employment, automobile operating costs, and other factors that will change over time. As such, future year forecasts are only as good as the assumptions that are made. Every effort has been made to ensure that the assumptions used in the development of the BMPO travel demand model are as reasonable and accurate as possible.

Transportation improvement projects needed within the planning horizon were identified

during the needs assessment. This list of improvement projects was then assessed using the evaluation criteria. Once completed, this list became the financially unconstrained project list and vision beyond the present financial limitations of the MTP.

Develop Funding Plan and Project Lists

A financial analysis was conducted to support development of the MTP. The analysis included a review of past transportation expenditures for Deschutes County, the City of Bend, Cascades East Transit, and ODOT. The financial analysis estimated the level of transportation-related funding that jurisdictions could reasonably expect to be available over the planning horizon. A summary of the financial analysis is discussed in the Revenue Analysis chapter (Chapter 19).

The financial limitations described by the financial analysis were merged with the project lists from the various systems (streets, transit, bicycle, pedestrian, transportation demand management, and transportation system management). Taking the financial limitations into consideration, funded (financially constrained) and illustrative (unfunded) project lists were prepared. The funded list includes only those projects that are within the present financial limitations of the implementing agencies. The funded list consists of a combination of the following six components to help meet the area's transportation needs for the next 20-25 years:

- (1) roadway improvements;
- (2) transportation system management (TSM);
- (3) transportation demand management (TDM);
- (4) transit service;
- (5) bicycle and pedestrian facilities; and
- (6) safety improvements.

The funded project list meets the definition of a financially constrained transportation plan and forms the basis for the MTP.

The projects in the illustrative list may not be relied upon as planned improvements until funding has been identified and the project moved into the constrained plan. Projects included in this currently unfunded category are identified in the Appendices.

The Committee Process

As with any regional effort, the update to the BMPO MTP occurred with significant collaboration and input from invested stakeholders and partnering agencies.

The agency and stakeholder involvement for this process used a Project Management Team, the BMPO Technical Advisory Committee (TAC), and the BMPO Policy Board to facilitate communication, support informed decision-making, and gain meaningful “buy-in” from all parties. Additional input was sought from other groups or organizations as needed through the process.

Policy Board

The BMPO Policy Board is composed of elected officials from each of the affected jurisdictions including City of Bend, Deschutes County, and ODOT. The BMPO Policy Board makes the final approval decision regarding the MTP. The BMPO Policy Board served as the ultimate decision making and adoption body for the MTP update.

Project Management Team

The Project Management Team consisted of the Bend MPO Manager, the City of Bend Growth Management Department Director, a planner from the City's Growth Management Department, a representative from ODOT Region 4 Planning, and the Consultant Team. The Project Team was responsible for the on-going management of the work effort, the completion of technical work, and communication with other project committees and stakeholders.

Technical Advisory Committee

The BMPO Technical Advisory Committee (TAC) served as a sounding board to the Project Team and provided overall guidance and technical input as needed throughout the work effort. In addition to the Project Team members, the TAC consists of representatives from the City of Bend, Cascades East Transit, Deschutes County, the Department of Land Conservation and Development (DLCD), and the Oregon Department of Transportation (ODOT) among others. For this update, the TAC will include representation from ODOT's Transportation Planning and Analysis Unit (TPAU) as well as ODOT Region 4 Planning staff. The Technical Advisory Committee (TAC) was responsible for gathering, reviewing, and validating technical information and data that were used in the update of MTP.

Citizen Advisory Committee

The Citizen Advisory Committee (CAC) makes recommendations to the Policy Board from the public's perspective on proposed long-range transportation plans and priorities for state and federal funding and other transportation issues.

Public Involvement

The Bend MPO public participation plan outlines a process for involving the public in the transportation planning process. The plan also allows for the BMPO to meet federal requirements which identify public involvement as a key component of the planning process.

Through the public involvement program and detailed technical analysis, transportation needs were identified and consensus was developed on system improvement strategies. Local agency staff and the Policy Board guided the planning effort for the 2014-2040 MTP. The Technical Advisory Committee had equally important participation.

The public participation program also included public notices of all TAC and Policy Board meetings during plan development. The public involvement process, in addition to being a federal and state planning requirement, is a priority of BMPO and the local agencies involved in development of the MTP.

Chapter 3: Existing Conditions

This Existing Conditions chapter was prepared for the original 2007 MPO MTP and was not updated during the 2014 update. Therefore, this chapter presents the existing conditions as of 2007. It will be updated during the next comprehensive MPO MTP update, after completion of the Bend UGB expansion.

Overview

The Bend Metropolitan Planning Organization (BMPO) is the regional transportation planning organization for the City of Bend urban area. It is formed of local governments and is responsible for overseeing transportation related planning decisions such as the approval of federal transportation funding for the Bend region in order to meet current and future transportation needs. Other responsibilities include creating and maintaining a comprehensive Metropolitan Transportation Plan (MTP) for the MPO area. The Bend MPO area is slightly larger than the City of Bend Urban Growth Boundary (UGB) and includes areas that are anticipated to develop into urbanized areas over the next 20-year horizon.

The MTP is designed to serve as the Bend metropolitan area's long term transportation plan. It addresses all travel modes, including pedestrians, bicycles, public transit, motor vehicles, freight, water, air, and pipelines, in an effort to address the region's long term projected transportation needs associated with future population growth. Projects identified in the MTP must be within projected levels of available financial resources and must also meet federal and state planning requirements. The primary objective of the plan is to identify both short-term and long-term actions in order to maintain the efficient movement of people and goods.

This chapter summarizes existing transportation operations and infrastructure within the Bend MPO boundary. Note that only highway, arterial, and collector roadways are discussed within this MTP. Field inventories conducted in spring 2006 and existing City of Bend and Deschutes County inventories were used to map existing transportation facilities in an effort to establish base year conditions. This existing inventory provides a framework (basis of comparison) for future assessment of transportation performance and needs within the Bend urban area transportation network relative to desired policies and goals.

Pedestrians

Figure 3-1 shows the existing sidewalk coverage along arterial and collector roadways in addition to existing trail inventory within the Bend MPO area. Network connectivity is typically carried out by means of collector and arterial roadways; therefore it is important to have sidewalk coverage along these roadways to provide pedestrians with

continuous connections. The existing sidewalk and trail infrastructure was assembled using City of Bend inventory¹ and field observations. As can be seen, significant portions of the arterial and collector roadway network currently have sidewalks on at least one side of the roadway, particularly in the downtown area and near residential land uses. Downtown Bend currently has fairly dense sidewalk coverage and is made up of mostly commercial, industrial, and residential land use that is characterized by a variety of small specialty retail shops, store front businesses and a historic grid roadway network. This dense sidewalk coverage therefore provides easy access to these small local businesses.

As mentioned, the majority of local streets in medium to high density residential areas feature sidewalks, which provide connections to major roadways and surrounding neighborhoods. This is likely due to the fact that the City currently requires sidewalks to be constructed on both sides of the roadway in new residential areas².

Overall, there is an estimated 60 miles of sidewalk coverage throughout the study area which is equivalent to approximately one-quarter of major roadway frontages³. In general, sidewalks are provided near and around schools and parks as illustrated in Figure 3-1. Sidewalks promoting access to local parks provide the public comfortable access to outdoor recreational facilities. Additionally, sidewalks leading to and surrounding school frontages is essential to ensure students have a safe route to school. With respect to this, the City of Bend is currently conducting a Safe Routes to School study. This program is intended to ensure children, grades kindergarten through twelve, have safe walking and biking routes within two miles of their respective school facility. The program helps communities target and reduce the number of hazards imposed on children while on their route to school. At this time, two schools in the City of Bend have participated in the program. The Safe Routes to School program stems from two pieces of legislation passed in 2005 (SAFETEA-LU and House Bill 2742).

While there is a significant amount of sidewalk coverage on arterial and collector roadways throughout the study area, there are considerable sidewalk coverage gaps that could be more in-filled to provide greater and safer pedestrian connectivity. Coverage gaps were defined where there is discontinuous sidewalk coverage along a single side of the roadway segment. Sidewalk coverage gaps were determined by visual inspection with no empirical analysis used. Table 3-1 lists several collector and arterial roadway segments which contain several sidewalk gaps. These sidewalk gaps are furthermore highlighted in Figure 3-1. Sidewalk gaps total to an estimated 61 miles in length.

¹ Paved and unpaved sidewalk GIS data provided by Bend MPO.

² Bend Urban Area Transportation System Plan, City of Bend, page 32, Adopted October 11, 2000.

³ *Ibid*

Of note, the City of Bend has planned to conduct an assessment of existing sidewalks to verify whether they comply with current American with Disabilities Act criteria⁴.

⁴ *ADA Revised Draft Guidelines for Accessible Public Rights-Of-Way*, Department of Justice, November 2005.

Figure 3-1

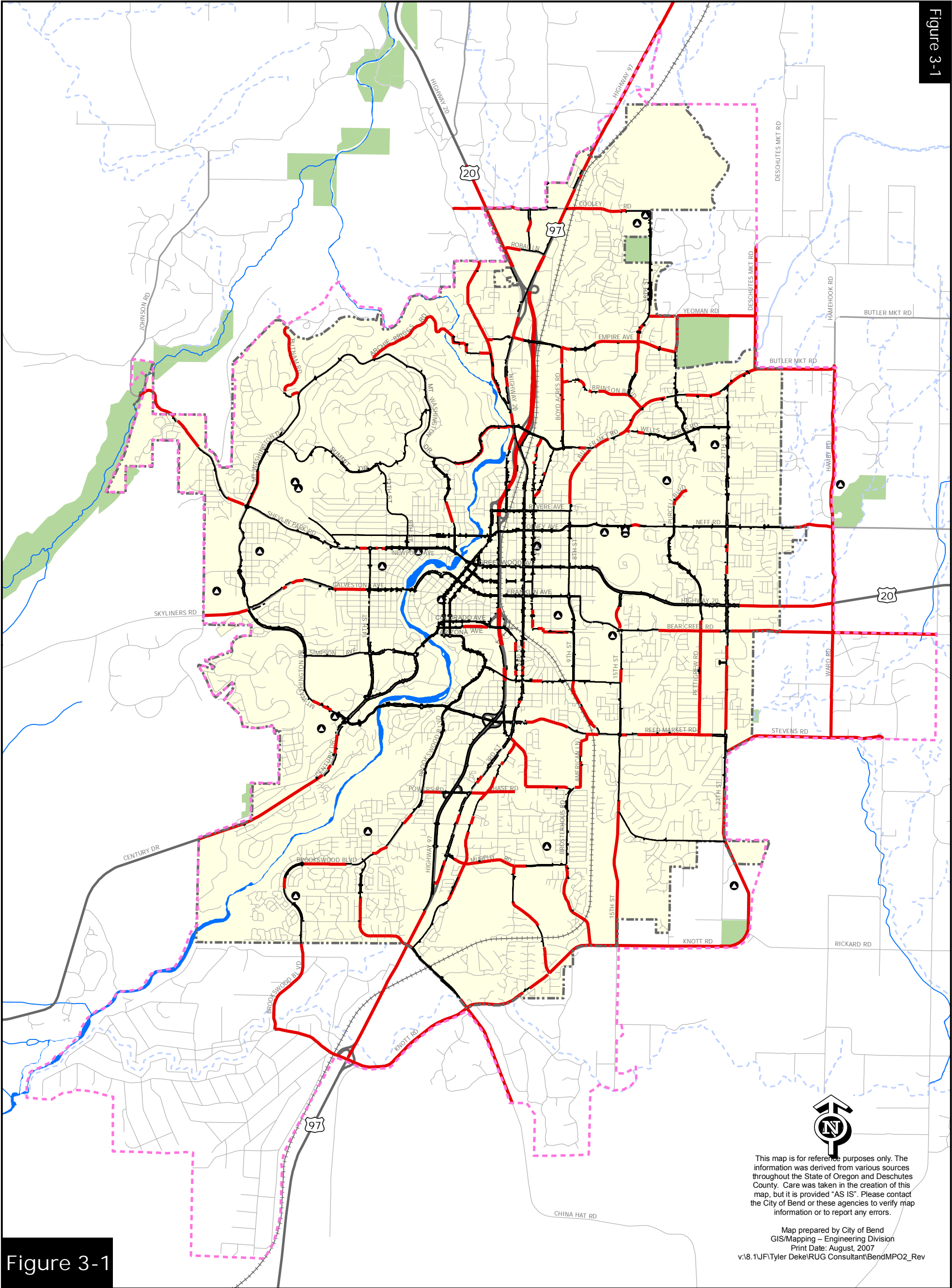


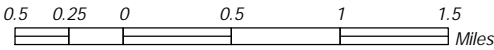
Figure 3-1

This map is for reference purposes only. The information was derived from various sources throughout the State of Oregon and Deschutes County. Care was taken in the creation of this map, but it is provided "AS IS". Please contact the City of Bend or these agencies to verify map information or to report any errors.

Map prepared by City of Bend
GIS/Mapping – Engineering Division
Print Date: August, 2007
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Bend MPO Pedestrian System

July 2006



Data sources include:
City of Bend
Deschutes County GIS
ODOT
DKS Associates



Legend

- | | | | |
|--|---------------------|--|----------------------------|
| | Sidewalk | | Parks |
| | Sidewalk Deficiency | | Railroad |
| | School | | MPO Boundary |
| | Highway/Expressway | | Bend Urban Growth Boundary |
| | Arterial/Collector | | City Limits |
| | Local | | Streams |
| | | | Canals |
| | | | River |

Table 3-1: Existing Sidewalk Deficiency Areas

Roadway	Limits	Functional Classification
Reed Market Road	3rd Street to 27th Street	Major Arterial
Empire Avenue	O.B. Riley to Purcell Boulevard	Major Arterial
27th Street	Bear Creek Road to Ferguson Road	Major Arterial
Bear Creek Road	Craven Road to east MPO boundary	Minor Arterial
Butler Market Road	Revere Avenue to east MPO boundary	Minor Arterial
Cooley Road	O.B. Riley to 18th Street	Minor Arterial
Boyd Acres Road	Ross Road to Empire Avenue	Minor Arterial
15th Street	Knott Road to King Hezekiah Way	Minor Arterial
Knott Road	Highway 97 to Ferguson Road	Minor Arterial
Galveston Avenue	14th Street to west MPO boundary	Minor Arterial
Century Drive	Mount Washington Drive to west MPO boundary	Minor Arterial
Baker Road	Brookwood Boulevard to Highway 97	Minor Arterial
Brookwood Boulevard	Hollygrape Street to Parkwood Court	Minor Arterial
Brookwood Boulevard	South city limits to China Hat	Minor Arterial
9th Street	Wilson Avenue to Reed Market Road	Minor Arterial
Neff Road	Eagle Road to east MPO boundary	Minor Arterial
Shelvin Park Road	McClain Drive to west MPO boundary	Minor Arterial
Brosterhous Road	Knott Road to Murphy Road	Major Collector
Brosterhous Road	American Lane to 3rd Street	Major Collector
American Lane	Brosterhous Road to Reed Market Road	Major Collector
O.B. Riley Road	North MPO boundary to Highway 20	
Murphy Road	3rd Street to Paulina Lane	Major Collector
Parrel Road	Grand Targhee Drive to Brosterhous Road	Major Collector
Ponderosa Street	Highway 97 to Poplar Street	Major Collector
Lodgepole Drive	Poplar Street to Mahogany Street	Major Collector
Country Club Drive	Knott Road to Murphy Road	Major Collector
Putnam Road	Mount Washington Drive to north MPO boundary	Major Collector

Roadway	Limits	Functional Classification
Chase Road	3rd Street to east end of roadway	Major Collector
Pettigrew Road	Reed Market Road to Twin Knolls Drive	Major Collector
Brinson Boulevard	Boyd Acres Road to Butler Market Road	Major Collector
Archie Briggs Road	Mount Washington Drive to O.B. Riley Road	Major Collector
Awbrey Road	Wilmington Avenue to Saginaw Avenue	Major Collector

Pedestrian Collisions

When looking at pedestrian travel, it is important to consider the safety aspects of the pedestrian system. Careful attention must be directed towards pedestrian crossings and where they are subject to high vehicle volumes. Using City of Bend⁵ records, locations of collisions involving pedestrians spanning the years 1995-2004 were identified and are illustrated in Figure 3-2. There were 80 collisions reported involving pedestrians during the 10-year span, yielding an average of 8 collisions per year. It appears that the majority of these collisions occurred on arterial roadways in the downtown area where pedestrian and traffic volumes are typically higher. Additionally, it appears that collisions occurred where sidewalks are currently present.

Interestingly, 56-percent of these crashes occurred at mid-block locations with the remaining 44-percent occurring at intersections. Of note, approximately 40-percent of the mid-block (23-percent of total collisions) collisions involving pedestrians occurred on 5-lane roadway segments. This may suggest the need for enhanced pedestrian crossings. Enhanced pedestrian crossings may include roadway lighting, signing, striping, textured crossings, medians, flashers, and curb extensions. Samples of enhanced pedestrian crossings within the study area are located at the intersections of Colorado Avenue/Arizona Avenue and Bond Street/Wall Street which both feature curb extensions and textured crossings.

⁵ Pedestrian collision data provided by Bend MPO.

Figure 3-2

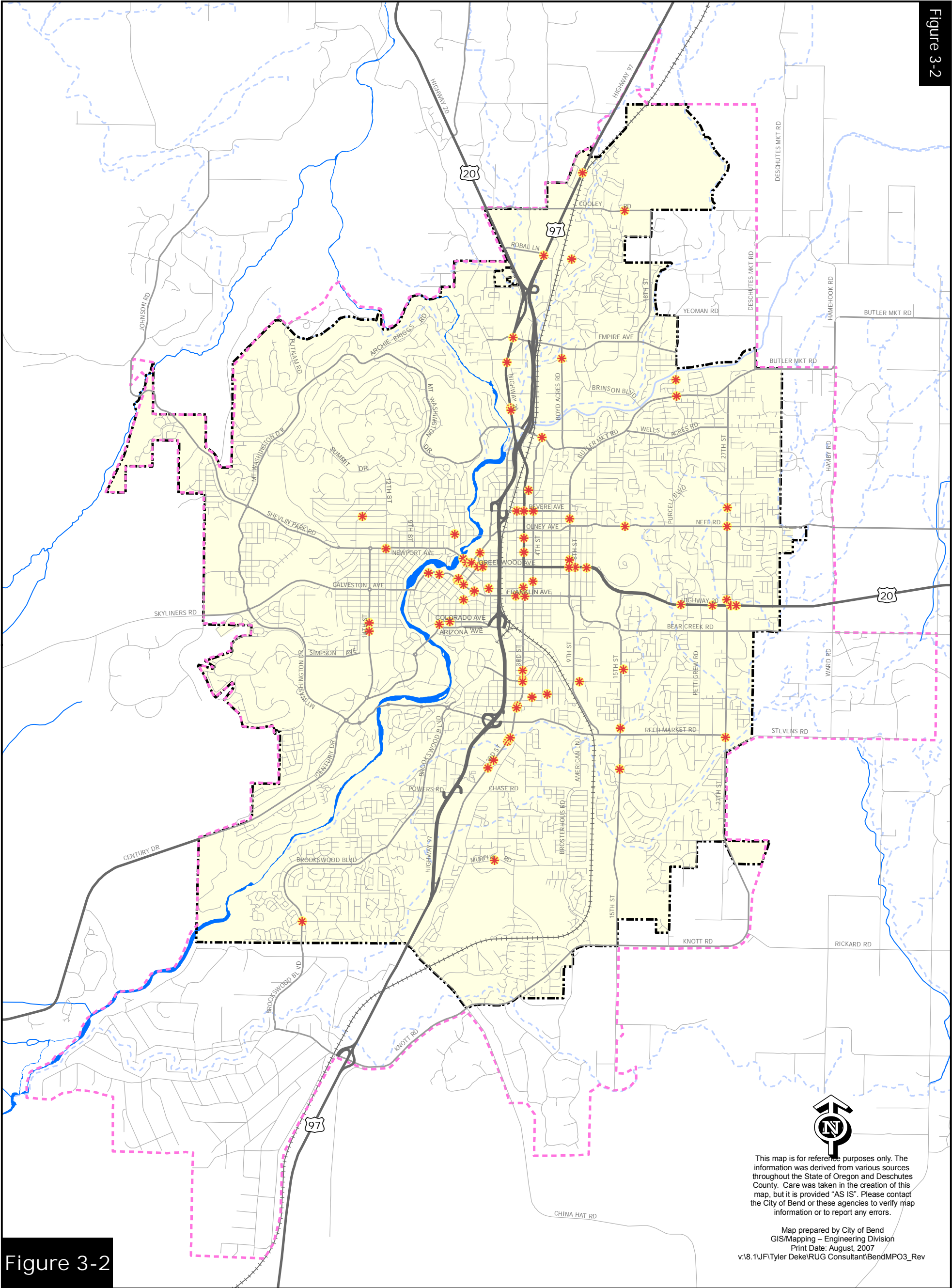


Figure 3-2

Bend MPO

Pedestrian Crashes (1995 - 2004)

July 2006

0.5 0.25 0 0.5 1 Miles

Data sources include:
City of Bend
Deschutes County GIS
ODOT
DKS Associates



Legend

- Pedestrian Crash
- Highway/Expressway
- Arterial/Collector
- Local
- Railroad
- MPO Boundary
- Bend Urban Growth Boundary
- City Limits
- Streams
- Canals
- River

Bicycles

Figure 3-3 shows the existing and proposed bicycle facilities in the Bend MPO area. These facilities were compiled using Deschutes County records⁶ in addition to field observations. The majority of the collectors and arterials in the study area provide on-street paved bike lanes. Bike lanes currently connect the north, south, east, and west city limits, providing cyclists a wide number of through route options. For the most part, bike lanes are provided on both sides of roadways totaling an estimated 83.5 miles in length⁷. In addition to the already large inventory of bikes lanes, the City of Bend has proposed many additional paved bike lanes to ensure adequate connectivity throughout the city. The proposed bike lanes are also shown in Figure 3-3 and add an estimated total of 36.7 miles to the bike system⁸.

In addition to on-street bike lanes, the Bend MPO area features many paved and unpaved trails and walkways that are also displayed in Figure 3-3. As shown, trails are provided almost along the entire extent of the Deschutes River within the study area providing a scenic route for walkers and bicyclists. Additionally, trails are provided leading to many of Bend's hilltops. There are approximately 28 miles of public trail facilities in the study area⁹. These trails serve as recreational facilities for walkers and bikers.

Overall, the existing bike lane and trail system provides substantially adequate connections to and from neighborhoods and schools, parks, and retail centers. Cyclists desiring to travel through the study area can select from the many designated routes on the major roadways or can share the road with motor vehicles on the lower volume, neighborhood streets to reach appropriate destinations.

⁶ Deschutes County GIS, Deschutes County GIS Service Center

⁷ *Ibid*

⁸ *Ibid*

⁹ Bend Urban Area Transportation System Plan, Adopted October 11, 2000, page 32, City of Bend.

Figure 3-3

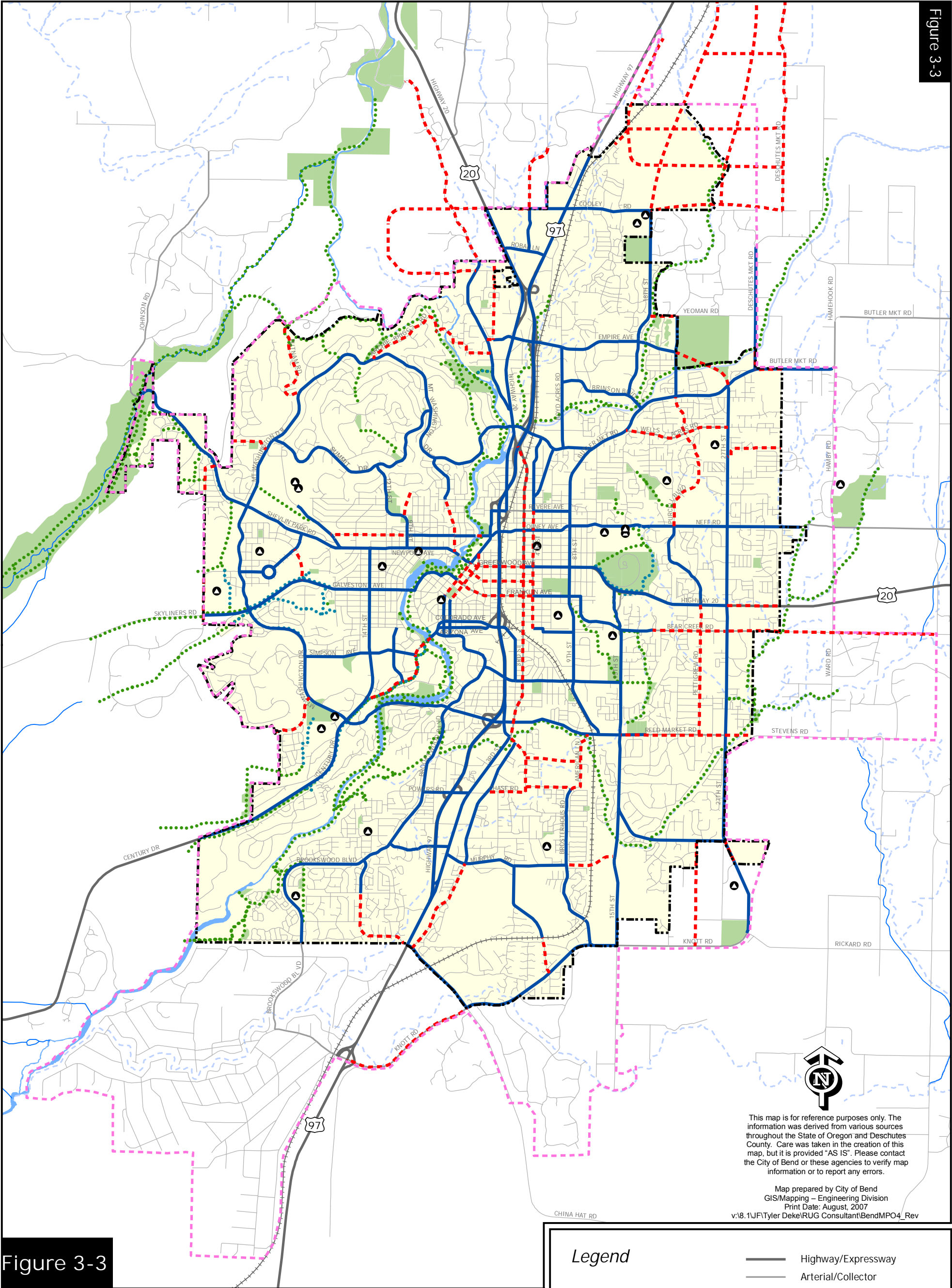


Figure 3-3

Bend MPO Bicycle System

August 2006

0.5 0.25 0 0.5 1 Miles

Source: DRAFT Bend MTP Existing Conditions Report July 2006



Legend

- Existing Bike Routes
- Proposed Bike Routes
- Paved Trails
- Unpaved Trails
- Parks
- Schools

- Highway/Expressway
- Arterial/Collector
- Local
- Railroad
- MPO Boundary
- Bend Urban Growth Boundary
- City Limits
- Streams
- Canals
- River

Transit

Existing Transit Services

NOTE: Transit service has changed significantly in Bend since the time of the 2007 plan development. There is now fixed route transit service within the Bend MPO area and plans to continue to enhance that service. This information will be updated to reflect current updated conditions as part of the Stage II update.

Transit service is provided throughout the study area by means of a Dial-A-Ride program. There is currently no fixed route public transportation system within the MPO boundary. The Dial-A-Ride program provides demand responsive transportation to the general public including seniors and those that are disabled. The 17-vehicle fleet, each wheelchair ready, offers service seven days a week with scheduled operating hours Monday through Friday from 7:15am to 7:15pm and Saturday and Sunday from 8:30am to 4:15pm. Single trips (per direction) are available for a fee of \$1.25 to the general public, \$1.00 for youths (ages 10-17), and \$0.75 for honored citizens. Free service is provided for youths ages 10 and younger when accompanied by an adult¹⁰. Table 3-2 summarizes the Dial-A-Ride ridership for the 2005 calendar year, aggregated by rider type¹¹. Rider type, as defined by Bend Dial-A-Ride is provided in Appendix C.

Table 3-2: Bend Dial-A-Ride Ridership Summary (2005)

Rider Type	Total Riders
General Public	15,038
Youth	4,460
Disabled	25,226
Honored Citizen	32,015
Senior	17,094
Other	7,137
Low Income	2,454
Medicaid	1,398
Overall	104,822
Note: Rider type based on Bend Dial-A-Ride classification. Each rider is classified as one rider type.	

A total of 104,822 riders were transported via the Dial-A-Ride system in 2005. This is a significant increase since the opening to the general public in 2002, when a total of 88,738 passengers were transported. Prior to 2002, service was only provided to

¹⁰ City of Bend Dial-A-Ride, http://www.ci.bend.or.us/depts/public_works/_dial_a_ride_public_transportation.html, accessed May 19, 2006.

¹¹ Email from Kathy Ostrom, City of Bend Dial-A-Ride, April 12, 2006.

seniors and those that were disabled. Since offering service to the general public in 2002, there has been an average 5 percent increase in ridership per year. This is comparable to the average increase in population over the same time period for the City of Bend which was approximately 6 percent per year¹². The average trip length per passenger on the system is just over 3 miles. Figure 3-4 illustrates the trend of increasing ridership on Bend's Dial-A-Ride system for the previous ten years.

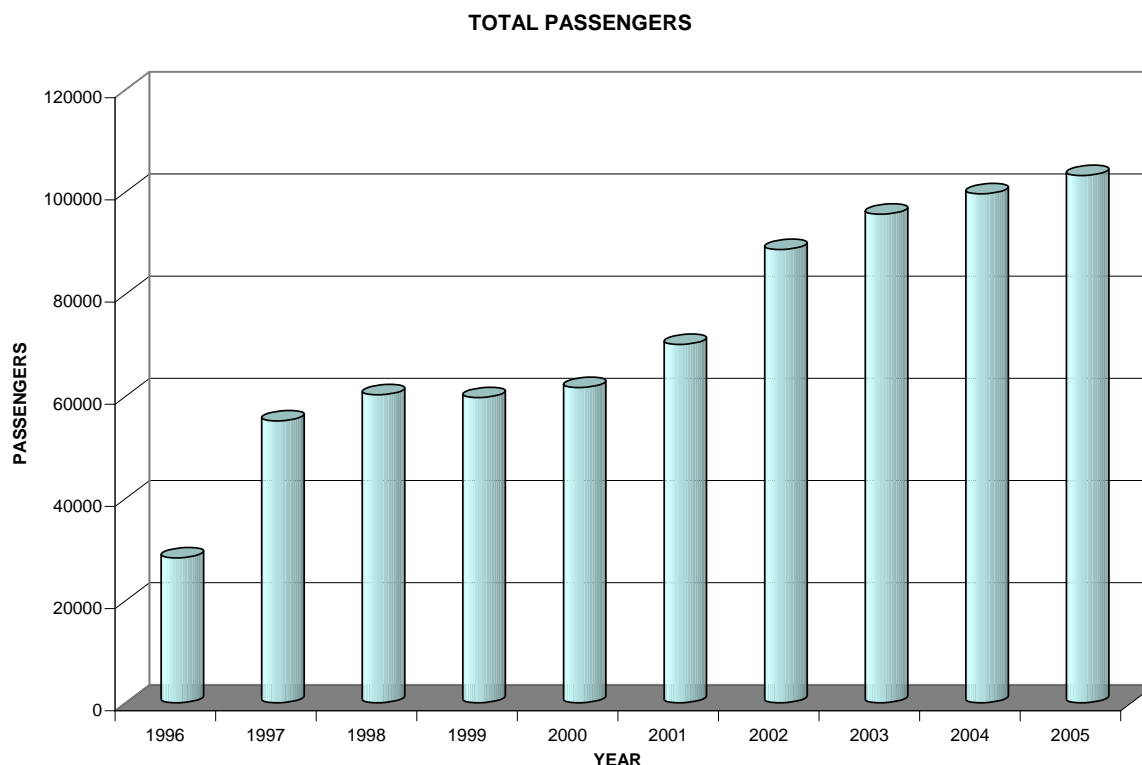


Figure 3-4: Bend Dial-A-Ride – Total Annual Ridership

Additionally, there are several commercial bus and airport taxi services within the study area. Porter Stage Lines offers daily scheduled bus service to and from Bend at 1315 NE 3rd Street (K Walker Enterprises Inc.). This station's operating hours are Monday through Friday 8:00am to 4:00pm and Saturday through Sunday from 8:30am to 2:00pm. Three Amtrak thruway buses currently pass through the study area. They are operated by Amtrak, Porter Stage Lines, and Valley Retriever Bus lines respectively. The nearest Amtrak station is in the city of Chemult, Oregon located approximately 65 miles south of Bend where Amtrak's Coast Starlight (Seattle-Portland-Los Angeles) passenger train passes through. Furthermore, People Mover offers bus service between Bend and John Day while C-A-C Transportation, Inc. provides daily shuttle service between Bend and Portland via the Central Oregon Breeze shuttle.

¹² Economic Development for Central Oregon, <http://www.edforco.org/>, accessed June 7, 2006.

Transportation to Bend's Mount Bachelor ski resort is provided via Mount Bachelor's Super Shuttle. Service is provided between the ski resort and their park and ride located at Colorado Avenue and Simpson Avenue during the winter season.

Planned Transit Services

A fixed-route transit feasibility study conducted in 1996 by the City of Bend found that fixed-route transit was feasible. However, when the option reached voting ballots in November 2000, the general public voted against the transit system. Voters again rejected the ballot for fixed route transit in the City of Bend in November 2004.

Recently, a Draft Service Plan¹³ for fixed route transit in the City of Bend was completed as an update to the previous feasibility study. This plan investigated three fixed route alternatives and four service level options (operating frequency level). Based on the draft plan, an all day 30 minute operating service level was recommended for weekdays along with a 60 minute operating service level on Saturday, and no service Sunday. The recommended route alternative would require a minimum 6 fixed-route vehicles. Revision of this plan is currently in progress with the preferred fixed route service options anticipated to begin September, 2006.

¹³ City of Bend Draft Service Plan, Nelson/Nygaard consulting associates, May 2006

Motor Vehicles

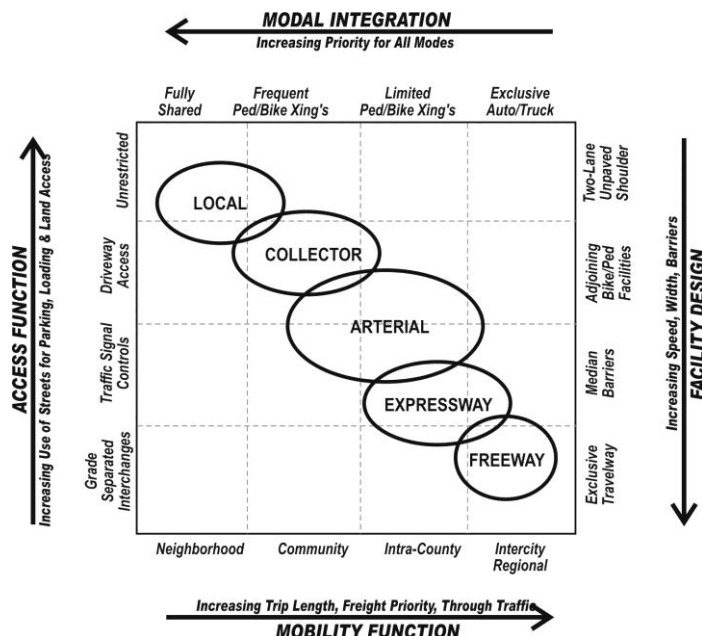
This section discusses the physical roadway infrastructure and motor vehicle travel characteristics within the study area. Summary of the existing roadway classifications set forth by the City of Bend and ODOT in addition to roadway characteristics, traffic operations, and traffic safety within the study area is included. These all play substantial roles in determining the existing conditions of the roadway network and help to target deficient areas. Key roadway characteristics such as speed limits, roadway cross-section, intersection control, and traffic volumes are addressed as these elements play key roles in defining the capacity and efficiency of the roadway network.

Functional Classification

The roadway functional classification system is designed to serve varying transport needs within the community. The schematic diagram shown below illustrates the competing functional nature of roadway facilities as it relates to access, mobility, multi-modal transport, and facility design. The diagram is useful to understand how competing objectives can have opposing effects. For example, as mobility is increased (bottom axis), the provision for non-motor vehicle modes (top axis) is decreased accordingly. Similarly, as access increases (left axis), the facility design (right axis) dictates slower speeds, narrower travel lanes, and non-exclusive facilities. The primary goal of selecting functional classes for particular roadways is to provide a suitable balance of these competing objectives.

The diagram shows that as roadway classes progress from local to collector to arterial to expressway (top left corner to bottom right corner) the following occurs:

- *Mobility Increases* – Longer trips between destinations, greater proportion of freight traffic movement, and a higher proportion of through traffic.
- *Integration of Pedestrian and Bicycle Decreases* – Provisions for adjoining sidewalks and bike facilities are required up through the arterial class, however, the frequency of intersection or mid-block crossings for non-motorized vehicles steadily decreases with higher functional classes. The expressway and freeway facilities typically do not allow pedestrian and bike facilities adjacent to the roadway and any crossings are grade-separated to enhance mobility and safety.



- *Access Decreases* – The shared uses for parking, loading, and direct land access is reduced. This occurs through parking regulation, access control and spacing standards (see opposite axis).
- *Facility Design Standards Increase* – Roadway design standards require increasingly wider, faster facilities leading to exclusive travel ways for autos and trucks only. The opposite end of the scale is the most basic two-lane roadway with unpaved shoulders.

The existing City of Bend functional classification system, as set forth in the City's Transportation System Plan (TSP)¹⁴, is shown in Figure 3-5. Both ODOT and Deschutes County roadway classifications are additionally shown in the figure. Roadway classifications are summarized in tabular form in Appendix C. The classification system is intended to allow for the safe and efficient movement of people and goods while optimizing certain objectives as noted earlier. There are a total of nine roadway classifications defined in the Bend TSP (expressway, principal arterial, major arterial, minor arterial, frontage road, major collector, local street, industrial street, and alley). This classification system is intended to serve the city over the next 20-year horizon.

Bend for the most part consists of a series of minor arterials which are responsible for the connection between large trip generators such as commercial and residential areas and consist of two to four travel lanes. These arterials provide a balance between access, mobility, multi-modal transport, and facility design within the study area. The collector roadways are intended to provide access and circulation to nearby arterial roadways in a multi-modal fashion. The Highway 97 and Highway 20 expressways traveling north/south and east/west through the city are intended to carry large vehicle volumes both through the city and to urban areas. These facilities have limited access and higher speeds and interestingly contain some bike lanes and sidewalks.

Roadway ownership and maintenance responsibilities of the various roadways in the study area are carried out by the City of Bend's Public Works Department and Deschutes County, with the exception of Highway 97 and Highway 20. These facilities are state routes and are under the jurisdiction of the Oregon Department of Transportation (ODOT).

¹⁴ Bend Urban Area Transportation System Plan, City of Bend, page 25, Adopted October 11, 2000.

Figure 3-5

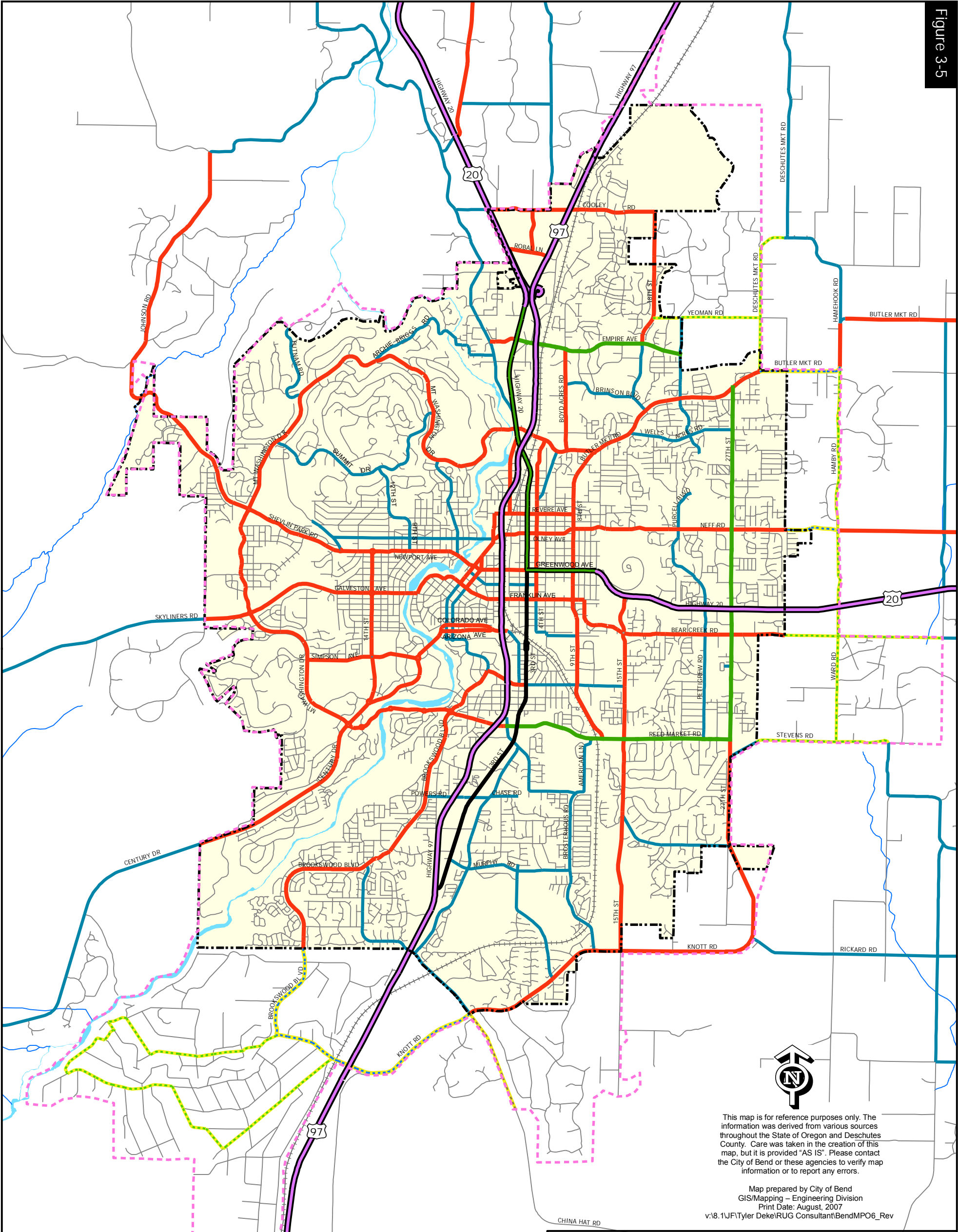
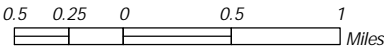


Figure 3-5

Bend MPO Roadway Functional Classification

July 2006



Data sources include:
City of Bend
Deschutes County GIS
ODOT
DKS Associates



Legend

- +++++ Railroad
- - - - - MPO Boundary
- - - - - City Limits
- Streams
- River
- Bend Urban Growth Boundary

Roadway Classification

- ODOT Statewide Expressway
- ODOT Statewide Highway
- County Forest Highway
- County Rural Arterial
- County Rural Collector
- City Principal Arterial
- City Major Arterial
- City Minor Arterial
- City Major Collector
- City Local

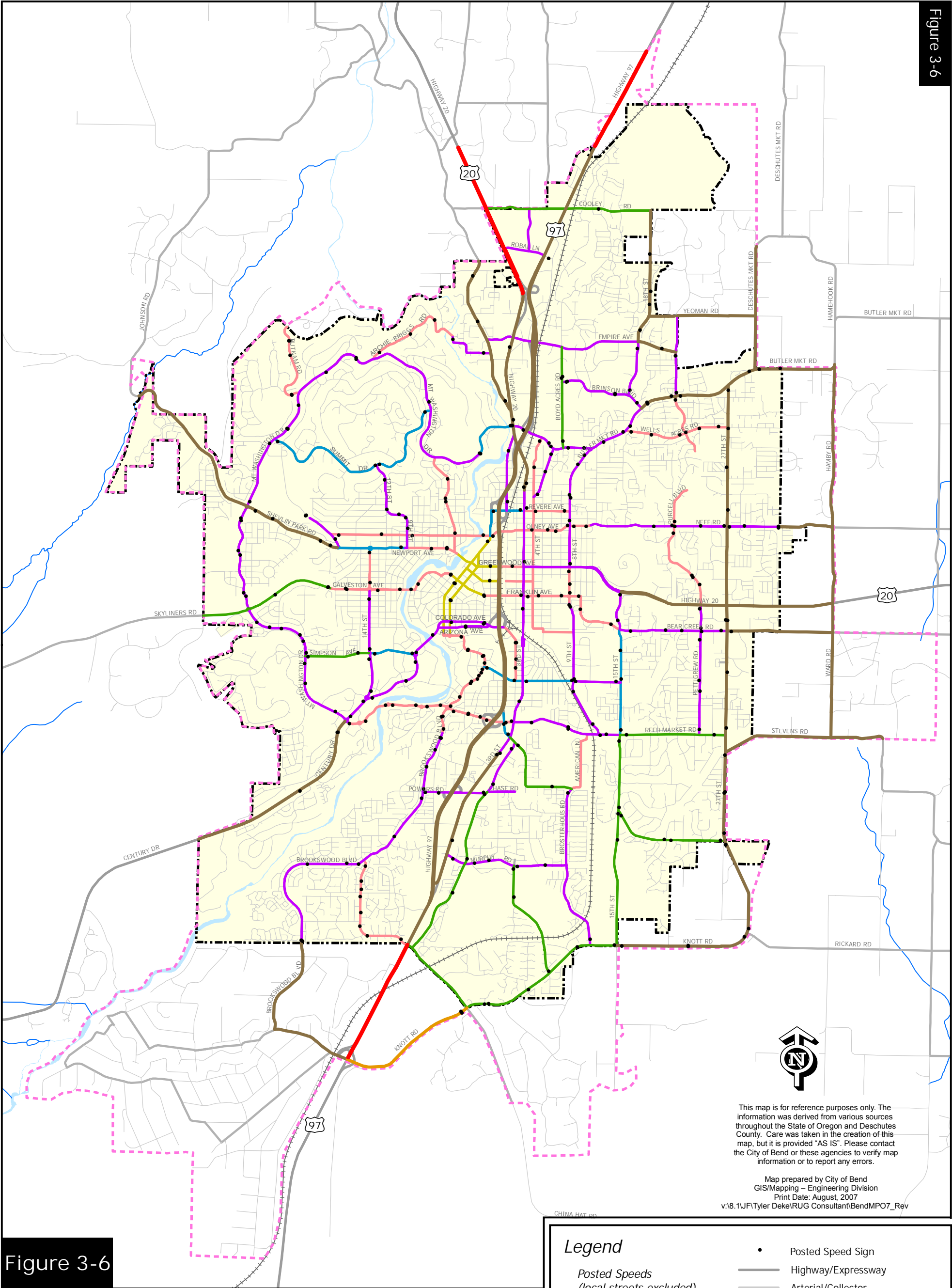
Roadway Characteristics

Field inventories and existing documentation were used to determine major roadway features within the study area. These features included posted speed limits, number of lanes per roadway segment, and intersection controls. Each of these features play key roles in defining roadway capacity and operating efficiency throughout the roadway network, which can influence travel path choices for drivers in Bend.

Figure 3-6 shows an illustration of posted speed limits on arterials and collectors within the Bend MPO boundary. The data were extracted from the City's existing inventory of speed limit signs. The majority of local roadways in Bend are posted at 20-25 miles per hour (mph). Major arterial roadways such as Reed Market Road and 27th Street have a speed limit ranging from 35-45 mph, while minor arterial roadways such as Newport Avenue, Butler Market Road, Mount Washington Drive, and Century Drive have a posted speed ranging from 25-45 mph. Collector roadways, including Portland Avenue and Parrell Road, have posted speeds ranging from 20-40 mph. Highway 97 as well as Highway 20 both have a posted speed limit of 55 mph outside of city limits. Within city limits, Highway 97 (Bend Parkway) maintains a 45 mph speed posting while Business 97 (3rd Street) and Highway 20 feature speed limits ranging between 35-45 mph.

Figure 3-7 shows the existing number of lanes on selected roadway segments in the study area. Highway 97, Highway 20, and Business 97 (3rd Street) maintain a cross-section of 4-5 travel lanes throughout the study area. For the most part, arterial roadways consist of 2-3 travel lanes featuring a shared center turn lane, while collector roadways maintain a two lane cross section. Local and County roads are 2 lane roadways.

Figure 3-6



Bend MPO Posted Speeds

July 2006

0.5 0.25 0 0.5 1
Miles

Data sources include:
City of Bend
Deschutes County GIS
ODOT
DKS Associates

Legend

*Posted Speeds
(local streets excluded)*

- 20 MPH
- 25 MPH
- 30 MPH
- 35 MPH
- 40 MPH
- 45 MPH
- 50 MPH
- 55 MPH

- Posted Speed Sign
- Highway/Expressway
- Arterial/Collector
- Local
- Railroad
- MPO Boundary
- Bend Urban Growth Boundary
- City Limits
- Streams
- River

Figure 3-7

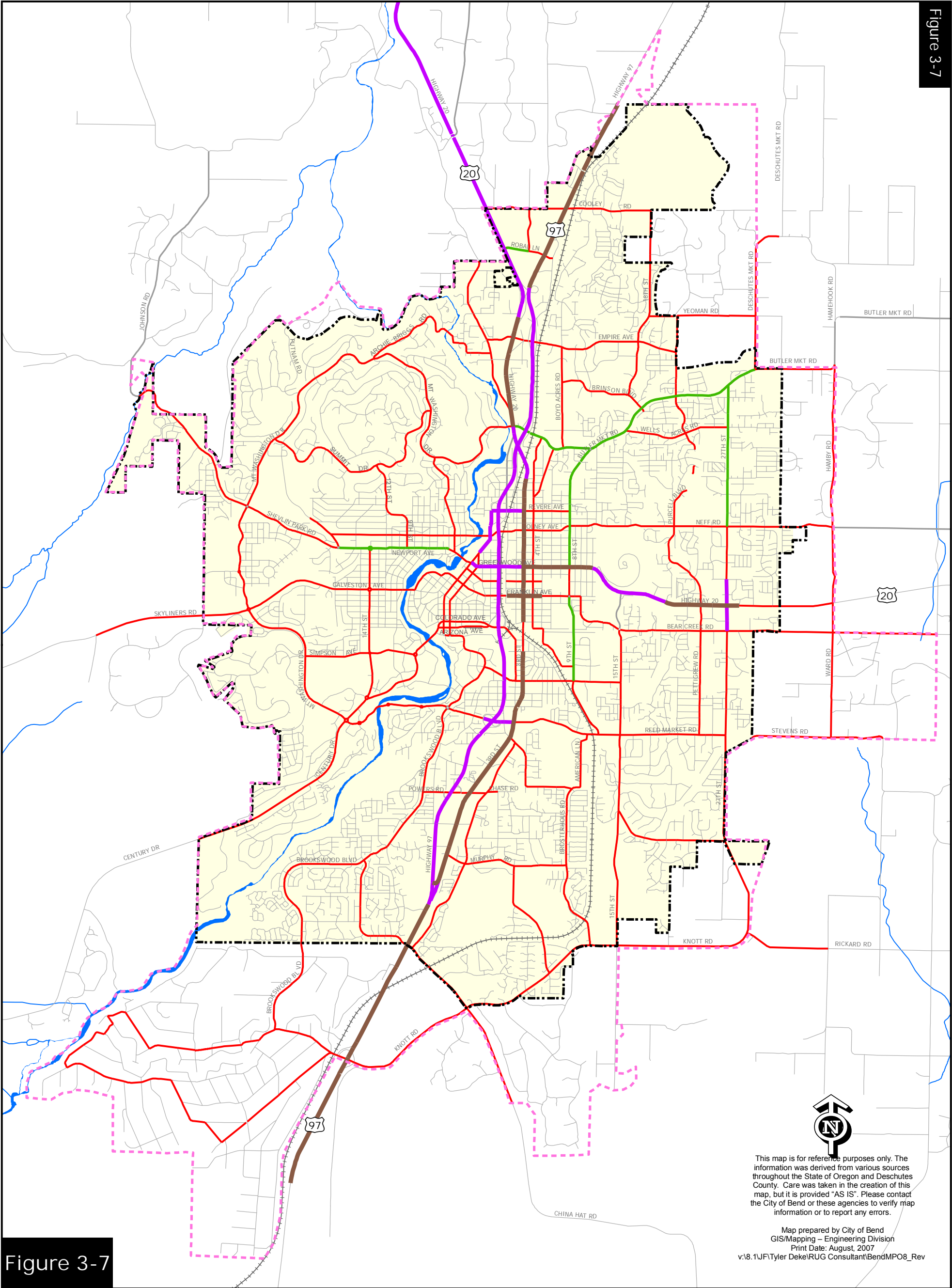


Figure 3-7


Bend MPO

Lanes

July 2006

0.5 0.25 0 0.5 1 1.5 Miles

Data sources include:
City of Bend
Deschutes County GIS
ODOT
DKS Associates



Legend

Number of Lanes

- 5 (Brown line)
- 4 (Purple line)
- 3 (Green line)
- 2 (Red line)
- Roads (Grey line)

- Railroad (Black line with cross-ticks)
- MPO Boundary (Dashed pink line)
- Bend Urban Growth Boundary (Yellow shaded area)
- City Limits (Dashed black line)
- Streams (Blue line)
- River (Blue wavy line)

Motor Vehicle Volume

The City of Bend maintains an active traffic counting program in which they conduct 24-hour directional traffic counts along selected roadway segments. This program began in 2003 with counts now being conducted yearly. These traffic counts are conducted on weekdays between the months of April through October. Figure 3-8 presents the bi-directional existing traffic volumes collected by the City of Bend during 2004-2005.

As expected, Highway 97, Business 97 (3rd Street), and Highway 20 carry the majority of traffic within the study area. Reed Market Road and 27th Street, both classified as major arterials, transport high levels of traffic throughout the day (20,000-30,000 vehicles). These two facilities join to connect downtown Bend and Highway 97 to high residential land uses. Arterial and collector roadways carry approximately 2,000-20,000 vehicles per day.

Traffic Operations Performance Standards

It is important to note that both Highway 97 and Highway 20 are classified as state facilities therefore they are subject to ODOT operational standards as set forth in the 1999 Oregon Highway Plan¹⁵. This plan states that these facilities must operate at a v/c ratio equal to or less than 0.80. The City of Bend additionally sets forth various intersection operational standards based on the type of intersection control. These standards are listed below and are based on measurements of v/c ratios and magnitude of delay¹⁶.

- Two-Way Stop Control
 - Total delay for individual lane groups must be less than or equal to 50 seconds, and
 - Volume to capacity ratio for individual lane groups must be less than or equal to 1.0, and
 - 95th percentile queuing must be less than or equal to available storage length.
- All-Way Stop Control
 - Total delay for the intersection must be less than or equal to 80 seconds.
- Roundabout
 - Volume to capacity ratio for individual approaches must be less than or equal to 1.0.
- Signalized Intersection
 - Total delay for the intersection must be less than or equal to 80 seconds, and
 - Volume to capacity ratio for the intersection must be less than or equal to 1.0, and
 - 95th percentile queuing must be less than or equal to available storage length.

¹⁵ Oregon Department of Transportation, Oregon Highway Plan, 1999.

¹⁶ City of Bend, Street Policy No. 6, Section 6.3, Adopted May 7, 2003

Figure 3-8

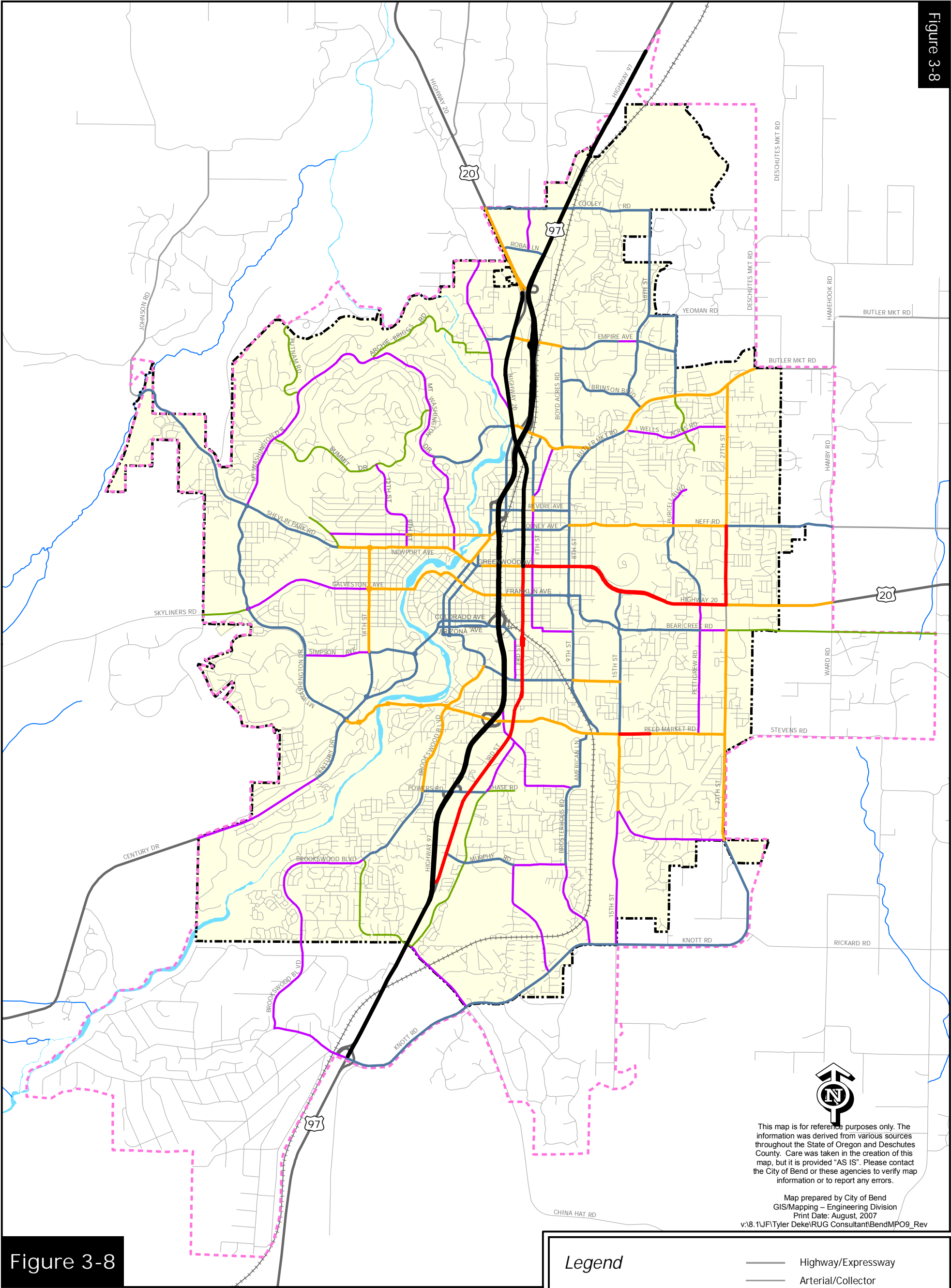


Figure 3-8

Bend MPO Link Traffic Volume (2-Way)

July 2006

0.5 0.25 0 0.5 1
Miles

Data sources include:
City of Bend
Deschutes County GIS
ODOT
DKS Associates



Legend

Average Daily Traffic Volume

- < 2000
- 2,000 - 5,000
- 5,000 - 10,000
- 10,000 - 20,000
- 20,000 - 30,000
- > 30,000

- Highway/Expressway
- Arterial/Collector
- Local
- Railroad
- MPO Boundary
- Bend Urban Growth Boundary
- City Limits
- Streams
- River

Traffic Operations

Level of Service (LOS), delay, and volume to capacity (v/c) ratios are typically used as measures of effectiveness for intersection operations. LOS is similar to a “report card” rating based upon average vehicle delay. Level of Service A, B, and C indicate conditions where traffic moves about without significant delays during periods of peak hour travel demand. Level of Service D and E are progressively worse peak hour operating conditions. Level of Service F represents conditions where average vehicle delay exceeds 80 seconds per entering vehicle at a signalized intersection and demand has exceeded capacity ($v/c > 1.0$). This condition is typically evident in long queues and delays. Unsignalized intersections provide levels of service for major and minor street turning movements. For this reason, LOS E and even LOS F can occur for a specific turning movement; however, the majority of traffic may not be delayed (in cases where major street traffic is not required to stop). LOS E or F conditions at unsignalized intersections generally provide a basis to study intersections further in efforts to determine the availability of acceptable gaps, safety and traffic signal warrants.

A volume to capacity ratio (v/c) is the peak hour traffic volume at an intersection divided by the maximum volume that intersection can handle. For example, a v/c ratio equivalent to 0.80 indicates that peak hour traffic is using 80 percent of the intersections capacity. If traffic volumes exceed capacity, queues will form and will lengthen until demand subsides below the available capacity. When v/c is less than, but close to 1.0, intersection operation becomes unstable and small disruptions can cause traffic flow to break down.

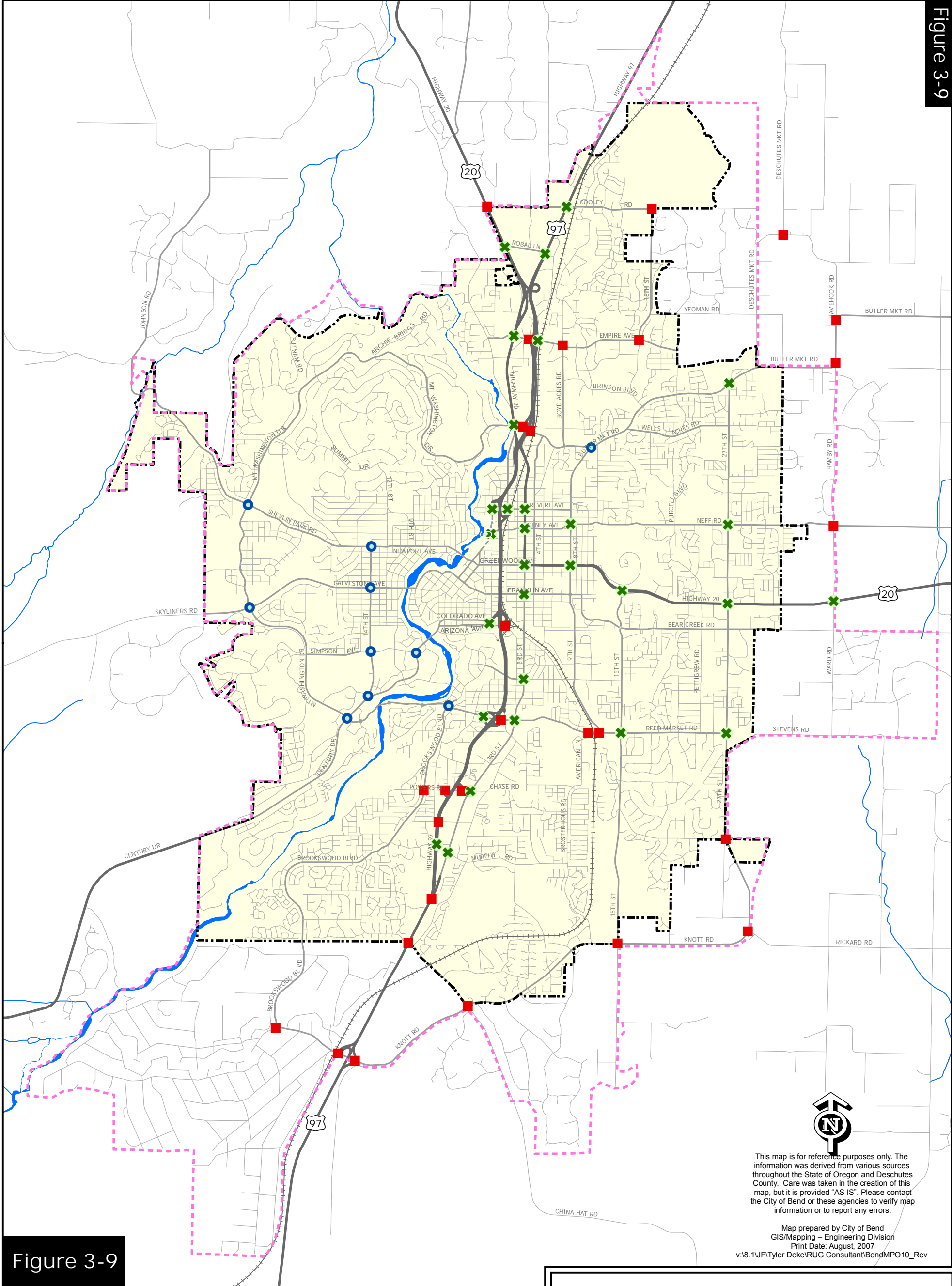
Intersection turn movement counts conducted during peak periods by the City of Bend were used in addition to intersection volumes documented in recent traffic analysis reports¹⁷ were used to determine the existing intersection capacity levels based on the *2000 Highway Capacity Manual* methodology for signalized and unsignalized intersections¹⁸. Analysis for modern roundabouts is based on the Federal Highway Administration’s (FHWA) guidelines. Seasonal adjustments were applied to Highway 97 and Highway 20 traffic volumes to reflect 30th highest hourly volumes based on 2004 records gathered from ODOT’s Automatic Traffic Recording (ATR) stations located on these facilities.

Study intersections and intersection control are highlighted in Figure 3-9. These intersections were selected based on consultation with Bend MPO staff. Study intersections are a representation of where traffic volumes are highest and where operations and capacity may be of concern. Table 3-3 summarizes the existing weekday peak hour intersection operational levels at the study intersections that either fail to meet operational requirements or are nearing capacity. Intersection operational levels for remaining study intersections are included in Appendix C.

¹⁷ 1) Newport Bridge Conceptual Design, Kittelson & Associates, Inc., December 2004. 2) Juniper Ridge Master Plan, Kittelson & Associates, Inc., January, 2006. 3) Reed Market Corridor Study, Parametrix, June 2005. 4) US 97 & US 20 Refinement Plan, Kittelson & Associates, November 2005.

¹⁸ *2000 Highway Capacity Manual*, Transportation Research Board, 2000.

Figure 3-9



Bend MPO Study Intersections

July 2006

0.5 0.25 0 0.5 1 Miles

Data sources include:
City of Bend
Deschutes County GIS
ODOT
DKS Associates



This map is for reference purposes only. The information was derived from various sources throughout the State of Oregon and Deschutes County. Care was taken in the creation of this map, but it is provided "AS IS". Please contact the City of Bend or these agencies to verify map information or to report any errors.

Map prepared by City of Bend
GIS/Mapping – Engineering Division
Print Date: August, 2007
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Table 3-3: Existing Weekday PM Peak Hour Intersection Level of Service

<i>Intersection</i>	<i>Level of Service</i>	<i>Delay (sec./veh)</i>	<i>Volume / Capacity</i>
Unsignalized Intersections			
ODOT Jurisdiction			
Highway 97/Ponderosa Road – China Hat Road	F/B	>100	0.88
Bend Jurisdiction			
Empire Avenue/Boyd Acres Road (all-way stop)	F	>100	>1.00
Empire Avenue/18th Street	F/B	>100	>1.00
Reed Market Road/American Lane	F/B	>100	>1.00
Roundabout			
Bend Jurisdiction			
Reed Market Road/Brookwood Boulevard	C	19.2	0.94
Signalized Intersections			
ODOT Jurisdiction			
Highway 20/Greenwood Avenue	D	51.8	0.93
Highway 20/27th Street	D	43.9	0.85
Highway 97/Cooley Road	C	25.1	0.86
Bend Jurisdiction			
3rd Street/Reed Market Road	D	47.4	0.90
27th Street/Neff Road	E	69.5	>1.00
Reed Market Road/15th Street	D	45.0	0.89
Portland Avenue – Olney Avenue/Wall Street	D	37.5	0.85
Olney Avenue – Neff Road/8th Street	D	43.3	0.88

Notes: Unsignalized Intersections:

A/A = Minor Street turn LOS/Major street turn LOS

V/C = Individual lane groups

Delay = Individual lane groups

Roundabouts:

V/C = Individual approach

Delay = Individual approach

Signalized and All-Way Stop Intersections:

Delay = Average vehicle delay in the peak hour for entire intersection in seconds.

Currently, four unsignalized study intersections (listed below) do not meet operational standards. Three of these intersections fall within City of Bend jurisdiction, while the intersection of Highway 97/Ponderosa Road-China Hat Road is under ODOT jurisdiction.

- Reed Market Road/American Lane
- Empire Boulevard/18th Street
- Empire Boulevard/Boyd Acres Road
- Highway 97/Ponderosa Road – China Hat Road

The northbound single lane approach at the intersection of Reed Market Road/American Lane suffers excessive delay (>100 seconds/vehicle) and has a v/c ratio of >1.0 which is greater than the maximum v/c ratio of 1.0 addressed as the City of Bend standard. This is due to minimal gaps on Reed Market Road during the PM peak hour which prohibits vehicles wishing to make a left turn onto Reed Market Road from doing so. The intersection of Empire Boulevard/18th Street also does not meet the city's standards with a v/c ratio >1.0 and delay of >100 seconds/vehicle on the southbound single lane approach. The all-way stop intersection of Empire Boulevard/Boyd Acres Road additionally does not currently meet city requirements yielding an average intersection delay of >100 seconds/vehicle, which is greater than the 80-second standard. The unsignalized intersection of Highway 97/Pondersa Road - China Hat Road yields a v/c ratio greater than the ODOT standard of 0.80 as set forth in the Oregon Highway Plan. The minor street consists of single lane stopped approaches which experience high levels of delay when attempting to access Highway 97, especially left turning vehicles. All remaining study unsignalized intersections meet specified operational criteria set forth by ODOT and the City of Bend.

All study intersection roundabouts are located within the City of Bend jurisdiction and currently meet city operational standards. The southbound approach at the roundabout located at Reed Market Road/Brookwood Boulevard is however nearing capacity. One study signalized intersection under City of Bend jurisdiction and three signalized intersections under ODOT jurisdiction do not currently meet traffic signal operations criteria and are listed below.

- Highway 20/Greenwood Avenue
- Highway 20/27th Avenue
- Highway 20/Cooley Road
- Neff Road/27th Street

The intersection of Neff Road/27th Street currently has a v/c ratio of >1.0 which is greater than the City of Bend standard. Moreover, the ODOT maintained signalized intersections of Highway 20/Greenwood Avenue, Highway 20/27th Avenue, and Highway 20/Cooley Road currently have v/c ratios greater than the 0.80 standard. All remaining signalized intersections meet both ODOT and City of Bend operations criteria.

There are five signalized intersections that are nearing capacity as listed below, four of which fall under City of Bend jurisdiction and one under ODOT jurisdiction.

- 3rd Street/Reed Market Road
- Reed Market Road/15th Street
- Portland Avenue – Olney Avenue/Wall Street
- Olney Avenue – Neff Road/8th Street
- Highway 20/27th Street

Attention should be directed towards these intersections in order to maintain efficient operations and maximize throughput.

Traffic Safety

Collision data for the previous five years (2001-2005) was obtained from the Oregon Department of Transportation (ODOT) for selected corridors within the study area¹⁹. Analysis focused on the identification of existing high collision segments by fusing 2004 Average Daily Traffic (ADT) volumes conducted by the City of Bend and ODOT with the provided collision records and respective segment length. Equivalent collision rates per million vehicle miles traveled (MVMT) were then determined for each respective segment and used as the basis of identifying high collision segments within the study area. The use of MVMT reflects the level of exposure relevant to each roadway segment. Table 3-4 summarizes the average collision rates per MVMT over the previous five years.

¹⁹ Oregon Department of Transportation, Collision data provided for 2001-2005. Note that 2005 collision data may be subject to change.

Table 3-4: Bend Roadway Segment Collision Rates (2000-2005)

Roadway Segment	Collision Type				Collision Severity			Total	Rate (per MVMT)	ODOT 2004 Rate (per MVMT) similar facilities
	Rear	Angle	Turn	Other	PDO	Injury	Fatal			
Reed Market Road										
Bond St. to Silver Lake Blvd.	0	2	2	3	7	0	0	7	0.84	2.04
Silver Lake Blvd. to American Ln.	37	27	46	10	70	50	0	120	3.24	2.04
American Ln. to SE 27th St.	43	2	11	19	40	34	0	74	2.14	2.04
27th Street										
Butler Market Rd. to Conners Ave.	8	4	12	4	18	10	0	28	1.06	2.04
Conners Ave. to Copperfield Ave.	34	15	27	13	54	35	0	89	1.81	2.04
Copperfield Ave. to Reed Market Rd.	8	1	5	1	2	13	0	15	2.09	2.04
Empire Avenue										
OB Riley Rd. to Boyd Acres Rd.	17	5	22	2	26	20	0	46	2.77	2.04
Boyd Acres Rd. to Purcell Blvd.	0	3	7	3	11	2	0	13	1.09	2.04
Business 97 (3rd Street)										
Greenwood Ave. to Brosterhous Rd.	82	31	89	27	128	100	1	229	2.84	2.04
Brosterhous Rd. Hwy 97/3rd St. (south)	22	21	54	15	61	50	1	112	1.29	2.04
Highway 97										
North MPO boundary to Nels Anderson Rd.	80	5	18	22	63	62	0	125	1.54	0.76
Nels Anderson Rd. to Greenwood Ave.	36	2	19	26	51	32	0	83	0.46	0.76
Greenwood Ave. to Reed Ln.	30	1	7	17	25	30	0	55	0.46	0.76
Reed Ln. to Hwy 97/3rd St. (south)	73	16	29	9	69	57	1	127	2.24	0.76
Hwy 97/3rd St. (south) to south MPO boundary	2	7	5	2	5	11	0	16	0.92	0.76
Highway 20										
North MPO boundary to Hwy 20/Hwy 97 (north)	8	0	2	3	5	8	0	13	0.27	0.76
Hwy 20/Hwy 97 (north) to	1	0	1	0	2	0	0	2	0.02	0.76

Roadway Segment	Collision Type				Collision Severity			Total	Rate (per MVMT)	ODOT 2004 Rate (per MVMT) similar facilities
	Rear	Angle	Turn	Other	PDO	Injury	Fatal			
Railroad track										
Railroad track to Greenwood Ave.	45	19	51	17	72	60	0	132	2.60	0.76
3rd St. to Pilot Butte Summit Dr.	38	17	59	22	79	57	0	136	3.59	0.76
Pilot Butte Summit Dr. to Purcell Blvd.	41	3	13	12	32	36	0	68	1.83	0.76
Purcell Blvd. to East MPO boundary	17	3	12	4	24	12	0	36	1.54	0.76

Notes:

- Other types of collisions include backing, pedestrian, head-on, sideswipe, parking, fixed object, non-collision, and miscellaneous.
- Injury includes A, B, and C type injuries
- PDO = Property damage only
- MVMT = Million vehicle miles traveled

These measured collision rates were compared to those of similar facilities as indicated in ODOT's 2004 Oregon State Highway Crash Rate Tables²⁰. The basis of comparison for similar facilities is based on urban city arterials and urban city expressways which had respective collision rates of 2.04 and 0.76 per MVMT in 2004.

It is important to note that the criterion for mandatory collision reporting was revised effective after December 31, 2003. Collisions before December 31, 2003 were required to be reported if they met the following:

- Death
- Bodily injury or damage to any one's property in excess of \$1,000

The revision consisted of changing legally reportable collisions to ones in which met the following for the driver:

- Death
- Bodily Injury
- \$1,500 damage to your vehicle
- \$1,500 damage to any one's property
- If any vehicle is towed from the scene due to damage.

This revision poses less stringent guiding principles for collision reporting which would attribute to an expected decrease in reported collisions. This is supported by 2004

²⁰ 2004 State Highway Crash Rate Tables, Oregon Department of Transportation, Transportation Data Section, August, 2005.

ODOT collision records where collision rates decreased by 54-percent and 17-percent for urban city arterials and expressways respectively.

Table 3-4 indicates that five collector/arterial roadway segments and seven highway/expressway segments analyzed have collision rates higher than similar state facilities. It must be noted that collision data analyzed contain data for three years under the previous mandatory collision reporting criteria and two years data under the new collision reporting criteria which is anticipated to yield a lower total number of reported collisions than previous criteria.

Reed Market Road

The segment between Silver Lake Boulevard and American Lane has an average collision rate over one-and-a-half times that of similar facilities. The majority of collisions occurring on this segment were a result of turn movements which is a reflection of vehicles turning onto Reed Market Road from minor street approaches. A significant number of these collisions occurred at the intersection of Reed Market Road/American Lane. The single lane approach at American Lane suffers excessive delay during peak periods and it is likely that drivers attempt to turn onto Reed Market Road when there are insufficient gaps. The intersections of Reed Market Road/Division Street and Reed Market Road/3rd Street, also in this same segment, were additionally engaged in numerous collisions. With respect to the segment between American Lane and SE 27th Street, the majority of collisions occurred at the intersections of Reed Market Road/SE 15th Street and Reed Market Road/SE 27th Street.

27th Street

There is one segment on 27th Street that experienced a collision rate higher than the compared normal. This segment is between Copperfield Avenue and Reed Market Road. This section yields a higher crash rate when compared to similar facilities due to lower traffic volumes which in turn yields a lower level of exposure.

Empire Boulevard

Empire Boulevard between O.B. Riley Road and Boyd Acres Road also has a higher than average collision rate. This section passes through the Highway 97 and Highway 20 interchanges which both experience high levels of traffic during peak periods. These collisions consisted mainly of rear end and turning movement collisions. Of note, Bend Parkway (Highway 97) opened in 2001, the first year of the analysis period.

Business 97 (3rd Street)

There are two study segments on Business 97 (3rd Street) that hold higher collision rates than similar facilities. Both of these segments are located within downtown Bend where 3rd Street consists of a 5-lane cross section and contains many traffic signals. Collision trends reveal a large number of rear end and turn movement collisions which are typically expected with traffic signals and turn

movements from minor streets onto a busy principal arterial. Of note, there was one fatality recorded over the previous five years on 3rd Street.

Highway 97

There are two study segments on Highway 97 where average collision rates are respectively two and three times higher than average. The segment between the north city limits and Nels Anderson Road experienced a significant number of rear end collisions. The intersections of Highway 97 and Cooley Road and Robal Road are signalized where the majority of collisions along this segment occurred. Recently, a shopping mall was introduced on the west side of Highway 97 between Cooley Road and Robal Road which in turn generated higher traffic volumes within the area. This high collision rate is likely attributed to the increase in traffic volumes associated with the shopping mall. The segment between Reed Lane and 3rd Street also experienced a large amount of rear end collisions. Highway 97 has a posted speed of 45 mph within this section and traffic signals are located at 3rd Street, Pinebrook Boulevard, and Powers Road. Of importance, there was one fatality experienced within this section. The sections of Highway 97 north and south of this segment do not contain any traffic signals. With this, these traffic signals are probable sources to the large number of rear end collisions along this segment.

Highway 20

Four segments analyzed along Highway 20 yielded higher collision rates than similar facilities. Three are all located on the east section, stemming from Business 97 (3rd Street). The segment between Business 97 (3rd Street) and Pilot Butte Access maintains a 5-lane cross section and has a posted speed of 25-35 mph. Throughout this segment are a large number of busy cross streets which is likely the source for the majority of collisions being the result of turn movements. The remaining two sections of highway 20 have a 4-lane cross section and have a posted speed of 45 mph. The largest percentage of collisions along these segments are rear ends. This is likely due to that both of these segments contain moderately spaced traffic signals.

The majority of crashes occurring on the northern section of Highway between the railroad tracks and Greenwood Avenue occurred at the busy intersection of Highway 20/Greenwood Avenue. The majority of these collisions were the result of turning movements and rear-ends.

Deschutes County High Crash Locations

Deschutes County currently maintains a listing of high crash locations within the county. The County has identified a total of 16 intersections that they have designated as high crash locations in Bend which are shown in Figure 3-10.

ODOT SPIS

Furthermore, ODOT maintains a Safety Priority Index System (SPIS) that ranks high collision locations along state facilities. The system provides a weighted score based on

the severity, frequency, and rate of collisions over the previous three years. Locations are aggregated into 0.10-mile segments. Only segments experiencing three or more collisions or one fatality over the three year analysis period are considered to be a SPIS site. The most recent ODOT SPIS data indicate that 21 one-tenth of a mile segments along Highway 97 and Highway 20 made the SPIS list for the 2001-2003 analysis period²¹.

²¹ ODOT, http://www.oregon.gov/ODOT/TD/TDATA/gis/odotmaps.shtml#SPIS_SIP_Maps

Figure 3-10

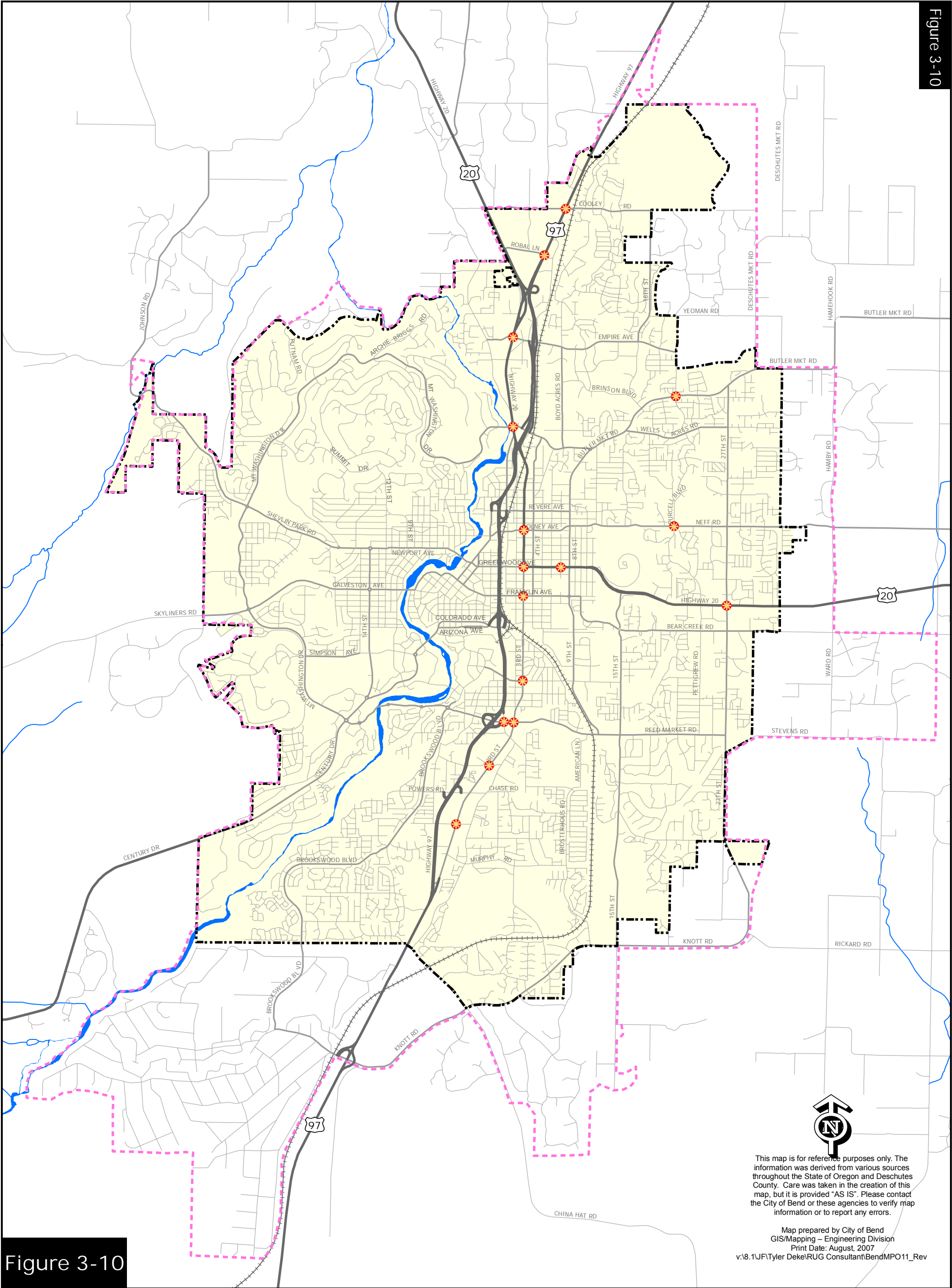
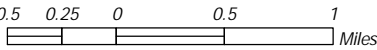


Figure 3-10

Bend MPO

Vehicle Crashes, 2000 - 2002

July 2006



Data sources include:
City of Bend
Deschutes County GIS
ODOT
DKS Associates



Legend

- High Incident Locations
- Highway/Expressway
- Arterial/Collector
- Local
- Railroad
- MPO Boundary
- Bend Urban Growth Boundary
- City Limits
- Streams
- River

Truck Freight

The movement of raw and furnished goods plays a vital role in our economy. The majority of these goods are transported via motor carrier; therefore efficient truck mobility is crucial to economic survival. The designation of through truck routes provides for this efficient movement while at the same time maintaining neighborhood livability, public safety, and minimizing maintenance costs of the roadway system. ODOT²² identifies Highway 97 (Bend Parkway) as a designated federal truck route and a state freight route. Highway 20 is designated a federal truck route through the entire study area. The following two sections of Highway 20 are designated state freight routes: 1) from the west study area limits to Empire Avenue and 2) from NE 11th Street to the east study area limits. These routes are identified in Figure 3-11. The surrounding arterial roadway system links these highways with nearby businesses located in the industrial and commercial zoning regimes. Table 3-5 summarizes available 2004 truck traffic as a percentage of ADT at several permanent ODOT ATR stations within the City of Bend.

Table 3-5: Existing Truck Volumes

Route	Automatic Traffic Recorder Location	2004 Average Daily Traffic	Truck ADT	Truck %
Highway 97	south of Revere Avenue	38,600	2,740	7.1
Highway 97	south of Empire Boulevard	41,300	3,550	8.6
Highway 97	0.9 miles south of Bend	22,150	1795	8.1
Highway 20	5 miles east of Bend	2,750	650	23.5

²² 1999 Oregon Highway Plan, Oregon Department of Transportation, May 1999.

Figure 3-11

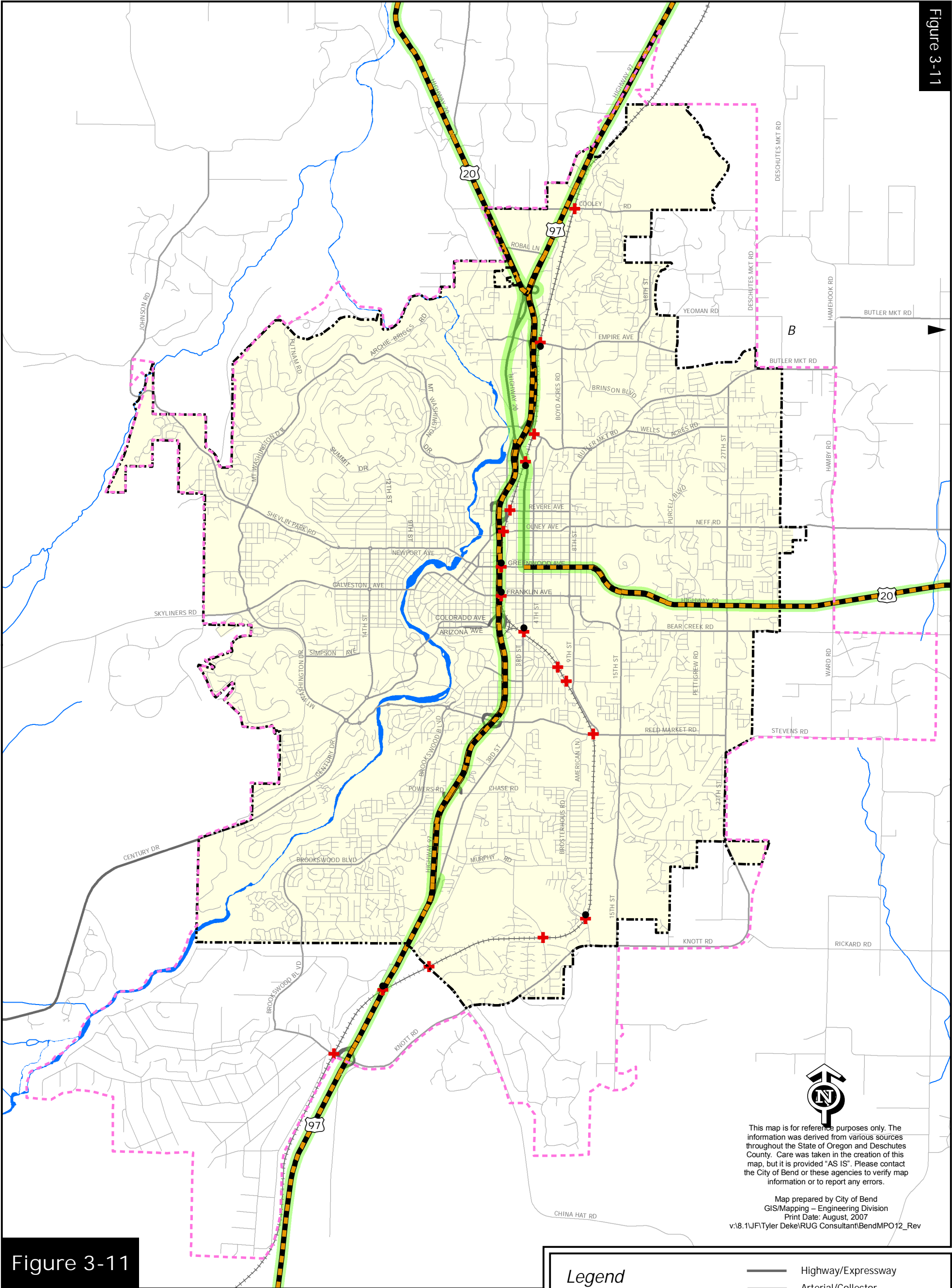
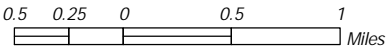


Figure 3-11

Bend MPO

Other Transportation Modes

July 2006



Data sources include:
City of Bend
Deschutes County GIS
ODOT
DKS Associates



Legend

Railroad Crossings

- At Grade
- Over Grade
- Under Grade

- Federal Truck Routes
- State Freight Routes

- Highway/Expressway
- Arterial/Collector
- Local
- Railroad
- MPO Boundary
- Bend Urban Growth Boundary
- City Limits
- Streams
- River

Other Travel Modes

There are four other modes of transportation in Bend included in this MTP: rail, pipeline, air, and water. The Deschutes River flows through the center of Bend and serves as a scenic and recreational waterway. There is no freight activity along this waterway within the study area therefore it will be left out of the remaining discussion. These remaining modes of transportation can all be seen in the previous Figure 3-11 with the exception of pipelines.

Rail Freight

Burlington Northern Santa Fe (BNSF) and Union Pacific (UP) currently operate manifest trains through the City of Bend. The rail track, owned by BNSF, runs parallel to Highway 97 at the north city limits before veering east just south of Colorado Avenue towards the industrial zone. The rail track is regulated under the Federal Railroad Administrations (FRA) class 2, 3 and 4 track standards. In this, there are no weight or dimensional restrictions for freight movements through the study area.

BNSF and UP combined for an estimated 13 million gross ton miles being transported through the study area in 2002²³. In 2005, BNSF was operating approximately 12-15 trains per 24 hours through the study area, while UP was operating one train daily in each direction. Additionally, BNSF operates a switch engine which transports freight to and from local businesses within the study area. The majority of freight being transported through the study area consists of various forest products, cement, diesel fuel, liquefied petroleum gas, wallboard, and other construction supplies²⁴.

With rail freight passing through the study area, attention needs to be directed towards the intersection of the rail track and the roadway. Railroad crossings were shown in Figure 3-11. Currently, there are a total of seventeen crossings. Of these, eleven are at-grade crossings featuring active traffic control devices (automatic gates). Of the remaining grade-separated crossings, three are over grade crossings where the railway travels over the roadway and two are under grade crossings where the roadway spans over the railway. For the most part, grade separated crossings are preferred so as to provide sufficient safety and eliminate large traffic delays. A review of the Reed Market Road at grade crossing over three consecutive weekdays yielded an average gate downtime of almost four minutes. Vehicle queues westbound on Reed Market extended back to 15th Street and beyond.

Gas Pipelines

Gas Transmission Northwest Corporation (TransCanada) currently operates high-pressure natural gas pipelines that run near Bend city limits. This pipeline extends between Kingsgate, British Columbia and Malin, Oregon thus traversing a distance of 612 miles. The pipeline currently passes through the southeast corner of the city limits and consists of 36-inch and 42-inch diameter pipeline that is capable of delivering up to

²³ Email from Bob Melbo of ODOT Rail Division to Tyler Deke of Bend MPO, January, 2006.

²⁴ *Ibid*

1 billion cubic feet (BCF) of gas per day to the Pacific Northwest; however typical daily operations are in the range of 600-700 million cubic feet per day²⁵. Cascade Natural Gas holds the role of distributing natural gas to the City of Bend through a series of 2-6 inch diameter piping. The maximum allowable operating pressure for the pipeline system is 911 pounds per square inch (psi).

Airport

The Bend Municipal Airport (Airport Identifier BDN) is located at 63136 Powell Butte Highway, approximately five miles northeast of city limits. It is a non-towered airport and classified as a Category 2 – Business or High Activity General Aviation Airport. In this, there is no scheduled passenger service to/from the airport. The existing single asphalt runway measures 75 feet in width and 5,005 feet in length serving approximately 42,000 annual aircraft operations (departures and arrivals) with an approximate average of 110 operations per day thus making it the 14th busiest airport in the state²⁶. The existing asphalt runway has been noted to be in fair condition. Approximately 180 aircrafts in combination with 18 aviation type businesses are currently based at the airport. The airport was established in 1942 in response to World War II training efforts.

The Oregon Aviation Plan²⁷ found runway length/width and weather reporting to be key needs for this particular airport in order to preserve the airport system over the next twenty years. Recently, an automated weather observation system capable of announcing wind speed, wind direction, day versus night, current temperature and dew point, precipitation, cloud layers (up to three) and ceiling (up to 12,000 feet above ground level), density altitude, barometric pressure, visibility (1/4 mile to 10+ miles), and lightning strikes/activity within and beyond 10 miles²⁸. Moreover, a new runway is anticipated to be completed in October 2007 which will replace the existing runway.

Pilot Butte Airport (Airport Identifier 8OR5) is a private use airstrip located south of Pilot Butte in the City of Bend. It consists of a 20 foot wide by 2400 foot asphalt runway.

²⁵ Phone conversation with Robert Latimer, TransCanada GTN & NBP System, May 9, 2006.

²⁶ Airport update #7, Bend Municipal Airport, April 18, 2006 (<http://www.ci.bend.or.us>)

²⁷ *Oregon Aviation Plan*, Oregon Department of Transportation, February 2000.

²⁸ Airport update #7, Bend Municipal Airport, April 18, 2006 (<http://www.ci.bend.or.us>)

Land Use

Land use plays a large role in driving transportation choices. Consequently, land use within the City of Bend is a key ingredient to understanding current transportation patterns and roadway traffic volumes. Industrial and commercial land uses are found within the central core of the city along Highway 97 and Highway 20, while residential land uses make up most of urban and rural Bend. Bend's Zoning Ordinance (NS 1178) and Subdivision Ordinance (NS 1349) control and regulate the most appropriate use of land within the City.

Currently, the Bend Area General Plan (BAGP) is the key source for setting forth goals, objectives, and policies linking transportation and land use within the City of Bend. This document is intended to provide guidance to local, state, and federal agencies, neighborhood and community groups, and anyone interested in development with making appropriate land use decisions with regards to future development that will help meet the future needs of the state, community, and citizens. The plan consists of a package of goals, text, exhibits, policies, and illustrative maps in an effort to lay out where and how changes should happen in order to accommodate the rapid population and economic growth. Both the City's zoning and subdivision ordinance are designed in compliance with the goals, objectives and policies as stated in the BAGP and are intended to implement the general plan.

It should be noted that the BAGP is subject to changes over time and should be revised to reflect new information and attitudes towards future transportation and land use needs.

Intelligent Transportation Systems

In efforts to further examine the existing transportation infrastructure in Bend, a review of existing Intelligent Transportation Systems (ITS) was carried out. These systems are intended to better manage the existing roadway system. The Deschutes County ITS Plan²⁹ was used as the basis for this section.

ITS Systems

Bend currently houses several ITS systems including remote weather information systems (RWIS), automatic traffic recorders (ATR), video detection cameras, closed circuit television (CCTV) cameras, and an oversize vehicle closure telephone system. Figure 3-12 provides an overview of current ITS deployments within the City of Bend. These are all monitored and managed by the Bend Traffic Operations Center (TOC) which is currently suited to successfully carry out tasks in incident management, emergency management, traffic management, traveler information, winter operations, and maintenance operations.

Six CCTV cameras are currently installed along Highway 97 (Bend Parkway). These cameras are used to monitor current traffic conditions and aid with incident, emergency,

²⁹ Deschutes County ITS Plan, DKS Associates, March 2005.

and traffic management strategies. Currently there are five ATR recorder stations within Bend city limits. These are all located on Highway 97 and Highway 20. Weather stations are used in an effort to aid travelers and maintenance crews of adverse weather conditions. There are two weather stations located in Bend in the northern part of the city. Typical measurements include air and pavement temperature, precipitation, wind speed and direction, and humidity. With the addition of new traffic signals and modifications, video detection systems are becoming more common. These units take the place of inductive loop detectors to allow for actuated traffic signal operations. A large sum of information reported from these field devices is broadcasted to the public via ODOT's Trip Check website.³⁰

³⁰ Oregon Department of Transportation, Tripcheck, (<http://www.tripcheck.com>)

Figure 3-12

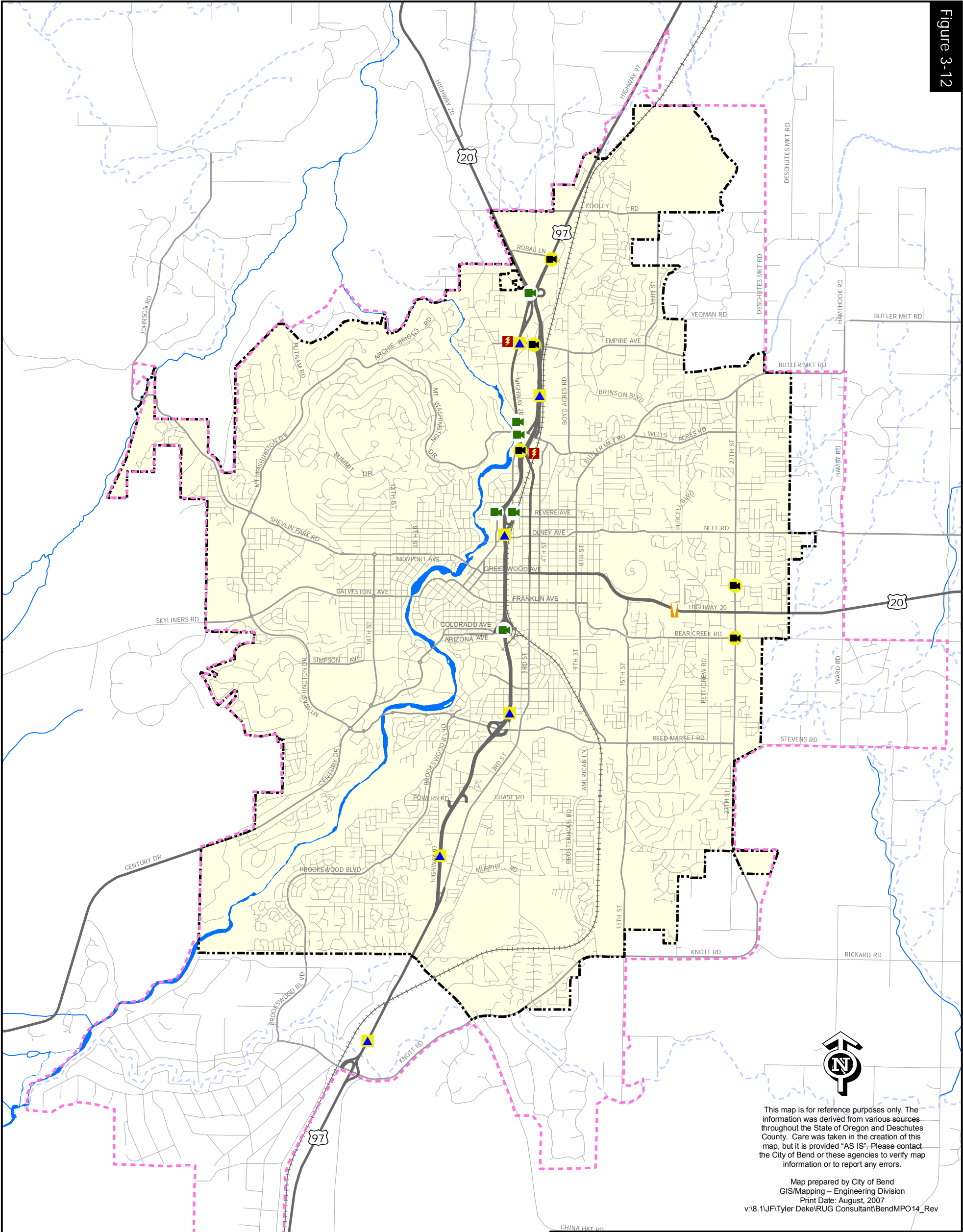
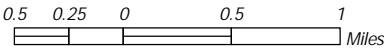


Figure 3-12

Bend MPO Intelligent Transportation System

July 2006



Data sources include:
City of Bend
Deschutes County GIS
ODOT
DKS Associates



Legend

- | | | | |
|--|---|--|----------------------------|
| | Weather Station | | Highway/Expressway |
| | Variable Message Sign | | Arterial/Collector |
| | Video Detection | | Local |
| | CCTV | | Railroad |
| | Automatic Traffic Recorder | | MPO Boundary |
| | Oversize Vehicle Closure Telephone System | | Bend Urban Growth Boundary |
| | | | City Limits |
| | | | Streams |
| | | | Canals |
| | | | River |

Chapter 4: Goals and Objectives

Introduction

The Goals and Objectives for the Bend MPO area reflect the transportation priorities of the jurisdictions within the MPO, the goals established by the state of Oregon and the guidelines set by the Federal Government for metropolitan regions.

The Goals and Objectives guided the development and evaluation of alternatives for the MTP. The Goals and Objectives will also serve to guide implementation of the MTP. They were used as a measuring stick to judge how well the alternatives and the final plan reflect values expressed by the community.

The Policy Board, with recommendations and suggestions from the TAC, developed and adopted the Goals and Objectives in July 2006. They have not specifically been revised as part of this 2014 update effort as they are still relevant and reflective of community values. As the MTP is updated in the future, the goals and objectives will be reviewed to assure that they reflect current regional priorities for the MTP as well as federal direction and requirements.

Goals and Objectives

Mobility and Balance

Goal 1

Provide a variety of practical and convenient means to move people and goods to, from and within the MPO area.

Objectives:

- 1) Expand opportunities for rail and air transportation for passengers and freight
- 2) Promote the development of a comprehensive public transportation system that is proportional to the scale and economy of the Bend MPO area
- 3) Promote non-motorized modes of transportation by constructing a system of safe and efficient transportation and recreation routes for pedestrians, bicyclists, and equestrians.
- 4) Identify and support the development of local evacuation routes for wildfire, seismic events and national security events
- 5) Identify and support the development of local freight routes
- 6) Support the through movement of goods and people on the state transportation system

Goal 2

Develop a transportation system that serves the needs of all travel modes, provides intermodal connectivity, and provides a range of transportation options throughout the MPO area

Safety and Efficiency

Goal 1

Address traffic congestion and problem areas by evaluating the broadest range of transportation solutions, including but not limited to:

- Operational improvements to maximize the efficiency of existing facilities;
- Construction of new transportation corridors;
- Transportation Demand Management (TDM) - bicycle, pedestrian and carpool strategies; and
- Transportation Systems Management (TSM) – Intelligent Transportation Systems (ITS), intersection operations and access management.

Goal 2

Serve the existing, proposed and future land uses with an efficient and safe transportation network

Goal 3

Design and construct the transportation system to enhance safety for all modes.

Objective

- 1) In cases where improving safety will also improve efficiency, these projects should receive funding priority

Accessibility and Equity

Goal 1

Provide people of all income levels with a wide range of travel options within the MPO area

Goal 2

Support all Americans with Disabilities Act (ADA) requirements and policies

Land Use

Goal 1

Integrate land use and transportation by encouraging land use patterns that provide efficient, compact uses of land that facilitate a reduced number and length of trips

Goal 2

Promote development patterns that preserve the life of the existing transportation system

Goal 3

Promote development that does not rely on primary access to the state transportation system

Environment and Livability

Goal 1

Recognize and respect the natural and historical features over which transportation improvements pass to minimize adverse impacts

Goal 2

Design transportation improvements that protect the environment by preserving air and water quality, minimizing noise impacts and encouraging energy conservation

Goal 3

Use context sensitive design principles when designing and locating transportation facilities

Economic Development

Goal 1

Implement transportation improvements that foster economic development and business vitality

Goal 2

Develop a transportation network with transportation options that enhance linkages between centers of employment, education, medical facilities and neighborhoods

Goal 3

Recognize the importance of intermodal connections and maintain adaptable approaches to trends and opportunities that enhance intermodal connections

Financially Responsible

Goal 1

Coordinate and design transportation improvements to assure the expenditure of resources in the most cost-effective manner

Objective:

- 1) Ensure that the costs of planned improvements are commensurate with the benefits

Goal 2

Maximize the ability to leverage alternative and multiple funding sources for transportation system improvements

Objectives:

- 1) Develop innovative and sound funding policies to implement the Plan, including cost-sharing and other partnership arrangements with the public and private entities when appropriate
- 2) Increase the diversity of funding sources to provide greater stability, predictability and flexibility for funding transportation facilities and services.
- 3) Investigate the user pays concept to leverage resources when transportation improvements will benefit specific properties planned for development

Chapter 5: Forecast Land Use

Introduction

Population and employment forecasts are developed to assist in planning for land use, transportation, infrastructure, and other needs. Forecasts are as good as the data and assumptions upon which they are based and require updates as new information becomes available.

Population and employment in the Bend area has shown cycles of slow and fast growth over the decades. During the 1970s, the population in Bend grew by almost 26 percent, while growth slowed somewhat in the 1980s. The 1990s saw another population surge that included the annexation of the entire area contained in the city's Urban Growth Boundary. Rapid population growth continued into the first half of the 2000s, followed by slower growth in the second half due to the recession of 2007-2009. The vast majority of the area's recent population growth is due to in-migration and is intertwined with the region's economic health. Long-term forecasts reflect national trends and show an eventual slowing of this growth. In the latter half of the 2000s, a global financial recession slowed growth nationally and in Bend. The impacts of the recession on population growth and fertility rates were also felt throughout the country.

The number and location of workers and housing have a significant impact on regional travel. Population and employment are essential inputs to the computer-based transportation model. Estimates of base year dwelling unit and employment, and future projections of these same variables are needed to forecast future traffic.

The population of the Bend area is expected to increase by about 50% over the next 18-20 years and nearly 84% in the next 25-30 years. This increase in population will have a significant impact on the transportation system. The transportation needs of the population, however, will be changing as well. An aging population will be more reliant on alternative modes of transportation. At the same time, the rapid growth of the Internet and other technologies may affect travel patterns and behavior. Therefore, not only is the amount of growth important, but also the forecast characteristics of the population.

Population Growth

Historical Census data for Bend, Deschutes County and the state of Oregon is illustrated in Table 5-1. Central Oregon has seen high population growth rates for much of the last 45 years. As shown in Table 5-1, the growth has been especially high in the last 10-15 years.

Table 5-1: Population Growth Summary

Year	1960	1970	1980	1990	2000	2010
Oregon	1,768,687	2,091,533	2,633,156	2,842,321	3,421,399	3,831,074
Change	---	322,846	541,623	209,165	579,078	409,675
% Change	---	18%	26%	8%	20%	12%
Deschutes County	23,100	30,442	62,142	74,958	115,367	157,733
Change	---	7,342	31,700	12,816	40,409	42,366
% Change	---	32%	104%	21%	54%	37%
Deschutes County*	11,137	16,732	31,700	54,489	63,338	81,094
Change	---	5,595	14,968	22,789	8,849	17,756
% Change	---	50%	89%	72%	16%	28%
Bend	11,963	13,710	17,263	20,469	52,029	76,639
Change	---	1,747	3,553	3,206	31,560	24,610
% Change	---	5%	26%	19%	154%	47%

*Deschutes County excluding the Bend population total. Source: US Census Bureau (data for 1960, 1970, 1980, 1990, 2000 and 2010).

Since the late 1990s, the trend of regional population growth being driven by in-migration has continued as demonstrated in Table 5-2. Deschutes County's rate of growth from in-migration has exceeded neighboring counties by growing at a rate of 10 percent over the seven year period. This illustrates that in-migrants play an important role in population growth and will likely play an equally important role in future economic growth.

Table 5-2: Population Change and In-migration trends for Deschutes and neighboring Counties (2000-2007)¹

County	Total Population change	Natural Increase (births over deaths)	Net Migration (in-migrants over out migrants)
Crook	6,703	284	6,419
Jefferson	3,021	22,770	1,959
Deschutes	45,443	4,805	40,638

Supporting the observation regarding in-migration in Deschutes County, Bend's population is composed mostly of people born in a different state. In 2012², only 40.2% of Bend's population was estimated to be born in Oregon. Whereas, in the U.S. and the State of Oregon, 60% and 46% currently reside in the same state they were born. The ACS 2012 data also shows that 53% of in-migration is from people born in other states and 6% from foreign born in-migration. From this, it can be concluded that in-migration to Bend is driven by out-of-state residents, not residents born in Oregon.

One aspect of particular interest to the future transportation needs of the region is the growth in the population of people age 65 and over. The central Oregon region is an attractive location for retirees. Between 2000 and 2010, this age group grew by

¹ City of Bend, Economic Opportunities Analysis, 2008.

² American Community Survey, 2012, (Table ACS12:C05002)

approximately 50% in Deschutes County (from 15,089 people to 23,491 people). In Bend, the 65 and over group comprises 12.5% of the population as of 2010.³

County Population Forecasts to 2040

In 1997, the Oregon Office of Economic Analysis (OEA) released their long-term population and non-agricultural payroll employment forecasts. The statewide population forecasts are linked to the national projections of population growth, but with a slightly higher rate for Oregon than the nation as a whole. Later that year representatives from Deschutes County, Bend, Redmond, and Sisters – in cooperation with OEA – agreed upon a coordinated County population forecast through the year 2020. In the fall of 2001, the Deschutes County Community Development Department led an effort to coordinate a local population forecast to year 2025. This effort was completed in 2004. The City of Bend then applied average annual growth rates to generate a forecast through year 2030 for use in the transportation analysis for the urban growth boundary expansion process⁴. The long-range population forecasts are shown in Table 5-2.

Table 5-2: Deschutes County 2000-2025 Coordinated Population Forecast

Year	Bend UGB	Redmond UGB	Sisters UGB	Unincorporated County	Total County
2000	52,800	15,505	975	47,320	116,600
2005	69,004	19,249	1,768	53,032	143,053
2010	81,242	23,897	2,306	59,127	166,572
2015	91,158	29,667	2,694	65,924	189,443
2020	100,646	36,831	3,166	73,502	214,145
2025	109,389	45,724	3,747	81,951	240,811
2030	119,009	---	---	---	---

In 2008, an updated Economic Opportunities Analysis (EOA) by the OEA was released. In this update, the EOA made predictions over a 20-year time period ending in 2028 based on Bend's recent economic and demographic trends. The EOA based the forecast based on many factors. Bend's population has grown at approximately 6 percent per year from 1990 to 2008, driven mostly by in-migration from people born in states other than Oregon. Population growth is not driven solely by in-migration from retired persons, but by working-age persons expected to be a part of the economy for decades to come. Baby-boomers will continue to represent the largest peak of population age structure in Deschutes County in the near future, but this peak is followed by a sizable wave of children and grandchildren who will be part of the workforce over the planning period. EOA concluded that population growth in Bend is expected to grow from 69,004 persons in 2005 to 115,063 persons in 2028.

Based on these trends, the Bend Metropolitan Planning Organization (BMPO) and the City of Bend made population forecasts for 2040. By 2040, the population is expected to grow to 140,861 persons within the Bend UGB.

³ Source: US Census Bureau (data for 2000 and 2010)

⁴ The City used annualized growth rates for Deschutes County that were developed by OEA.

The following table summarizes the 2000-2040 updated population forecast from the Office of Economic Analysis and utilized by BMPO and the City of Bend:

Table 5-3: Bend UGB 2000-2040 Population Forecast

Year	Bend UGB	Pop. Growth	%Pop. Growth
2010	76,639		
2028	115,063	38,424	50.1%
2040	140,861	64,222	83.8%

Employment Trends

In recent years, the central Oregon region has undergone a dramatic shift in its economic structure. Due to a reduction in commercial timber available from federal lands, employment in the lumber industry has declined sharply. The region, however, has seen a sizable increase in overall employment. The employment base has greatly diversified over the past 10 years.

Growth in tourism has had a significant impact on both the statewide and local economies. Central Oregon is a major tourist destination. In 2004, Deschutes County ranked fifth in the state for total travel expenditures. Because of its central location to many cultural and recreational activities, the MPO area frequently serves as the home base for tourists during their stay in Central Oregon.

Structural changes in the local economy impact the demand placed on the transportation system. For example, industrial employment generates very few trips per employee while retail employment generates a large number of trips per employee. If, for example, 100 industrial employees are shifted to new retail sector positions, there would be a large increase in trips placed on the transportation system.

In addition, the geographic distribution of retail and service employment is typically more dispersed than traditional, large industrial sites. Because of these factors, future travel demand will change significantly as the economy continues to evolve.

The updated Economic Opportunities Analysis (EOA), released by OEA in 2008, also forecasted employment growth. In this update, the EOA concluded that job growth in Deschutes County is expected to be some of the highest in the state over the next 10 years. Manufacturing is expected to grow statewide and in Deschutes County, but not at levels seen during the 1990s through 2007. Bend is well positioned to grow employment in its targeted economic sectors including: hospitality, higher education, health care, secondary wood products, renewable energy resources, aviation, recreational equipment manufacture, specialty manufacturing, and information technologies. Threats to Bend's economic success include limited land supplies, high housing costs, and lack of workforce housing.

Growth in total employment within the Bend urbanized area is forecast to increase steadily over the next 30 years. Much of this growth is expected to occur in the trade and service sectors. Employment in retail trade is expected to double and growth in wholesale trade is expected to triple by 2040. By far, the maximum growth in employment is expected in Transportation, Communications, Utilities sector (250% growth) and in the Construction industry (228% growth). Service industry employment is projected to grow by 83 percent. Additionally, manufacturing employment is forecast to grow 63% and F.I.R.E. (Finance, Insurance, Real Estate) is forecast to grow 64%. The long-range employment forecasts are shown in Table 5-3.

Table 5-4:

Year	Agriculture/ Forestry	Mining	Construction	Manufacturing	Transportation, Communications, Utilities	Wholesale Trade
2010	406	46	2,311	3,178	1,002	1,001
2040	655	367	7,596	5,197	3,543	3069
Change	+249	+321	+5,285	+2,019	+2,541	+2,068

(cont)

Retail Trade	FIRE	Service	Government	Total Employment
6,288	2,276	22,708	1,547	40,763
12,958	3,741	41,666	1,991	80,783
+6,670	+1,465	+18,958	+444	+40,020

Source: 2010 data from Oregon Department of Transportation (ODOT)

Further details on population and employment data and projection methods are available from the Bend MPO.

Vehicular Travel Demand

Locations with high traffic volumes today are expected to be the locations with the highest traffic volumes in the future. The highest traffic volumes in the region are forecast to occur on Highway 97 (the Parkway). High traffic-volumes are also expected on Highway 20 (3rd Street/Greenwood Avenue), Reed Market Road, 18th Street, O.B. Riley Road, Empire Avenue, and 27th Street. Vehicle miles of travel (VMT) in the MPO are currently (year 2010) estimated to be approximately 108,000 miles during the PM peak hour. By 2040, PM peak hour VMT within the MPO is expected to be approximately 171,500 miles (a 59 percent increase).

Trends in population and employment in the Bend area mirror those of the nation. A variety of societal changes has had a significant impact on transportation demand. Over the last 30 years, an increasing percentage of women have entered the labor force. This contributes to increased demands on the transportation system. National statistics from the Census indicate that over the last 30 years, many transportation-related factors have grown much more rapidly than has the nation's population, which increased by less than 40 percent. The number of workers increased by almost 80 percent, but the number of vehicles per household increased by almost 180 percent. The number of

vehicles per household increased by more than 60 percent, while the number of persons per household fell by 20 percent⁵.

Land Use - Transportation Connection

In recent years, several studies have been undertaken to identify the linkages between transportation and land use issues. These studies have generally focused on changing land use distributions along regional transit networks to help decrease automobile travel and increase the convenience of walking, biking, and public transportation. These studies have demonstrated that projected travel demand could potentially be accommodated through means other than building new freeways and adding lanes to existing roads.

The Oregon Transportation Planning Rule (OAR 660, Division 12) was adopted in 1991 to implement Statewide Planning Goal 12 (Transportation). Specific provisions of the TPR include reducing reliance on the automobile, improving mobility and accessibility for bicyclists, pedestrians, and public transportation users, and avoiding air quality problems associated with traffic congestion⁶. While the overall success of the TPR is still being debated, it has helped provide for a coordinated approach to transportation planning in Oregon. Because of the Transportation Planning Rule, multi-modal needs and land use issues are now routinely part of local transportation planning activities.

In March 2013, the Bend Metropolitan Planning Organization (BMPO) published the *Public Transit Plan and Transit Corridor Land Use Assessment*. The document provides an assessment of land use and public facilities opportunities and constraints along potential transit corridors in Bend. Corridors throughout the city were evaluated for a number of elements that would create future opportunities for transit service expansion or upgrades, including residential and non-residential development potential, existing and planned public facilities, existing and future roadway and multimodal improvements, and projected future traffic congestion. Six corridors identified as having significant future transit potential were selected for additional evaluation and consideration as “primary transit corridors.” The plan identifies areas to coordinate transit and land use investments; especially along primary transit corridors.

High-density residential development, commercial and employment opportunities are anticipated around primary transit corridors. The *Public Transit Plan and Transit Corridor Land Use Assessment (2013)* forecasts the extent and development intensity anticipated around high-priority transit corridors (primary transit corridors). The following table summarizes current and projected population and employment characteristics within a quarter-mile walking distance of each corridor:

⁵ Source: US Census Bureau (2000 and 2010).

⁶ Both Goal 12 and the Transportation Planning Rule (OAR 660-012) are available online through <http://www.oregon.gov/LCD/pages/index.aspx>.

Table 5-4: Summary Statistics for Land Use Analysis Corridors

Corridor	Area ¹	2010 Population	2030 Population	& Pop. Growth	2010 Employment	2030 Employment	% Empl. Growth
27 th Street (Wells Acres to Reed Market)	827	3,991	5,917	48%	3,997	4,495	12%
3 rd Street (South) (Hawthorne to Murphy)	640	2,184	3,128	43%	3,504	5,191	48%
3rd Street (North) (Hawthorne to Cascade Village)	773	1,155	2,498	116%	5,323	7,842	47%
Greenwood (3rd to 27th)	711	2,804	4,166	49%	2,782	3,285	18%
Galveston (3rd to NW 14th)	481	2,312	2,796	21%	3,984	4,369	10%
Newport (3rd to NW 14th)	475	2,227	2,779	25%	4,588	4,739	3%

Note: 1- Indicates Area of 1/4 mile walking (network) buffer around the corridor. Area represents gross acres. **Source:** 2010 Population from U.S. Census Bureau. 2010 Employment from Oregon Employment Department and Bend MPO. 2030 Population and Employment Projections from Bend MPO.

Chapter 6: Motor Vehicles

Introduction

Motor vehicles remain the primary mode for transporting goods and people within the BMPO planning area. The physical roadway infrastructure and the motor vehicles it supports play a vital role in the BMPO planning area's social and economic livelihood. Efficient movement of motor vehicles supports the economic vitality of the region and maintains the mobility of its residents. Identifying needs and deficiencies in the roadway system is an important step in maintaining and improving the flow of motor vehicles. Most new motor vehicle projects also have provisions for bicycles and pedestrians facilities that enhance the multi-modal transportation system.

This chapter outlines the basic assumptions through the future year (2040), including forecasts of future population and employment and the resulting demand on the regional arterial and collector roadway network. Two different future transportation network scenarios were evaluated:

- 2040 Committed Improvements
- 2040 Preferred Alternative

The Metropolitan Transportation Plan (MTP) is a financially constrained plan; the Preferred Scenario includes projects recommended for implementation that can be financed with existing and anticipated funding resources over the planning period. The Preferred Scenario identifies regionally significant projects, primarily on arterial road segments and generally excludes local and collector streets. Some collector street projects have been included due to their impacts on the regional transportation system, while other collector street deficiencies that were identified and corresponding improvement projects are addressed in the Bend Transportation System Plan (TSP).

As part of this MTP update, the future network scenarios were evaluated with a link-based system analysis (demand-to-capacity). Previous MTP analysis and other local agency efforts identified system deficiencies at both the link and intersection level. The 2040 model results were used to identify the system link deficiencies and to select projects for the Preferred Scenario. Key intersection improvement projects identified in the previous MTP Preferred Scenario or other local agency planning efforts were also included.

Although the majority of projects included within this plan have funding sources, some additional projects are identified that go beyond the immediate availability of known funding trends. These projects ("Illustrative Plan") address capacity and connectivity issues that were not addressed in the Preferred Scenario. The designation and inclusion of these extra projects are important to future planning efforts, as they allow right-of-way needs to be preserved and allow opportunities for new funding that becomes available to be applied to projects that have been already been identified as

addressing future deficiencies in the regional transportation network. These extra roadway projects are included in an “Illustrative” list near the end of the chapter.

Several other planning studies are underway that will influence the expected transportation conditions in the greater Bend Planning Area. These studies include:

- US 97 Bend North Corridor Project
- Bend Urban Growth Boundary (UGB) Expansion
- Bend Westside Integrated Land Use and Transportation Plan
- Bend Central Multimodal Mixed-Use Area (MMA) Plan

Findings and recommendations that result from these ongoing planning efforts will be amended into the Bend MTP and incorporated into future MTP. A more rigorous alternatives analysis will also be conducted after the Urban Growth Boundary process is complete as part of subsequent MTP and TSP updates.

Goals and Policies

The goals and policies of the Bend MTP were developed based on a review of the existing goals outlined in other regional and local plans. The Oregon Highway Plan provides guidance on the standards of performance necessary for motor vehicles on the state highway facilities. The region also has specific goals and policies outlined within the local transportation plans (Deschutes County Comprehensive Plan, Deschutes County Transportation System Plan, and the City of Bend Transportation System Plan) that are specifically related to motor vehicles. The goals that were created and adopted will help guide the future development of the roadway network and select specific projects for implementation. The motor-vehicle goals are included in Chapter 4 of this plan.

Performance Standards

A variety of performance measures have been developed and adopted by governing jurisdictions to evaluate how well the transportation system operates under existing and future conditions. This plan focuses on link demand/capacity (d/c) ratios at the corridor level. For future MTP Updates, further model refinement and post-processing may be used to incorporate intersection level of service measures into the analysis.

Forecasts and Needs

The existing conditions analysis is summarized in Chapter 3 of this plan and identified a series of transportation needs and existing deficiencies. These needs, along with the adopted goals and policies developed for the future direction of the transportation network, provide the starting point for the future year analysis.

Forecasted Land Use

Land use is a key factor in developing a functional transportation system. The amount of land that is planned to be developed, the type of land uses and how the land uses are mixed together have a direct relationship to expected demands on the transportation system. Understanding the amount and type of land use is critical to taking actions to maintain or enhance transportation system operation.

The Bend MPO travel demand model was developed by the Transportation Planning Analysis Unit (TPAU) at ODOT (Oregon Department of Transportation). The travel demand model was used to determine future traffic volumes within the study area. Complete land use data sets were developed by MPO, City, and County staff and TPAU for the following conditions.

- Existing 2010 Conditions (base travel forecast for the region)
- Future 2040 Conditions

For transportation forecasting, the land use data is stratified into geographical areas called transportation analysis zones (TAZs), which represent the sources of vehicle trip generation. There are 463 TAZs within the BMPO planning area model; each TAZ represents land use and the access to the transportation system within the planning area. This land use database includes the population, the number of residential dwelling units (households), and employees within specific TAZs. The totals that were assumed for each category in the Bend MPO travel demand model for the base (2010) and future year (2040) are summarized in Table 6-1.

Table 6-1: Land Use Summary

Land Use	2010	2040	Increase	Percent Increase
Population	92,343	164,082	71,739	78%
Households	37,852	65,168	27,316	72%
Employees	40,763	80,783	40,020	98%

* Note: The Bend MPO model extends significantly beyond the BMPO boundary. The land use totals shown in Table 6-1 are for the entire model area.

In Table 6-1, the employee category only includes the total number of employees, though the travel demand model utilizes a range of employment types (retail, service, industrial, and other). All employment category areas exhibit significant growth during the planning horizon. This growth was converted to forecasted travel demand and then applied to the existing transportation network to determine the future deficiencies of the motor vehicle system, as explained in the next section.

Forecasted Travel Demand

The determination of future transportation needs in the BMPO planning area requires the ability to accurately forecast travel demand resulting from estimates of future population and employment. The objective of the transportation planning process is to provide the information necessary for making decisions on when and where

improvements should be made to the transportation system to meet the forecasted travel demand.

Traffic forecasting can be divided into several distinct but integrated components that represent the logical sequence of travel behavior. These components and their general order in the traffic forecasting process are as follows:

- **Trip Generation-** The trip generation process translates land use quantities (number of dwelling units, number of employees) into vehicle trip ends (number of vehicles entering or leaving a TAZ).
- **Trip Distribution-** This step estimates how many trips travel from one zone (TAZ) in the model to any other zone. Distribution is based on the number of trip ends generated in each zone pair and on factors that relate the likelihood of travel between any two zones to the travel time between zones.
- **Mode Choice-** This step determines how many trips will be made by various modes (single-occupant vehicle, transit, carpool, etc.).
- **Traffic Assignment-** This step allocates trips between an origin and destination by a particular mode to a route, where each traveler is assigned to the path with the shortest travel time.

The initial roadway network used in the traffic model was the streets and roadways identified in the existing conditions chapter (Chapter 3) of this plan. A future 2040 Committed Scenario was analyzed to identify existing deficiencies and motor vehicle infrastructure needs. The Committed Scenario assumes that the BMPO planning area will experience its projected growth in population and employment and the demand for the transportation facilities will increase accordingly. The Committed street network includes TSP projects identified in the adopted plan, that have committed funding to construct, either through the City's Capital Improvement Program (CIP), the Oregon Statewide Transportation Improvement Plan (STIP), or other privately funded road improvements. The transportation improvements assumed for this scenario are listed in Tables 6-2 and 6-3. This scenario serves as the basis of comparison for the other future year (2040) scenario that will be evaluated.

Table 6-2: Highway and Arterial Projects (Committed)

Location	From	To	Improvement	Jurisdiction	Construction Status
Reed Market Rd	15 th Street	27 th Street	3-lane collector modernization with bike lanes and sidewalks	Bend	Complete
Reed Market Rd	15 th Street		Intersection Improvement – will convert from signal to partial multi-lane roundabout	Bend	Under Construction
Reed Market Rd	American Lane		Re-align American Lane (straighten road and add traffic signal at Reed Market intersection)	Bend	Under Construction

Location	From	To	Improvement	Jurisdiction	Construction Status
Reed Market Rd	4 th Street	15 th Street	3-lane collector modernization with bike lanes and sidewalks	Bend	Under Construction
Murphy Rd Phase 1			Re-align Murphy Rd, Murphy Rd overcrossing of US 97, hwy access modifications, roundabout at Murphy/3rd	Bend/ODOT	Under Construction

Table 6-3: Collector Roadway Improvements (Committed)*

Location	From	To	Improvement	Construction Status
New E-W Collector	Brosterhous Rd	American Lane	New 2-lane road	Future date (TBD)

Note: * This list of improvements is intended to focus on regionally-significant improvements and there may be other committed local City projects that are not listed here.

The Bend MPO travel demand model is a useful tool for determining future deficiencies in the transportation network. The model was created using average annual weekday daily traffic volumes. These volumes reflect average conditions, but neglect the seasonal variations that are characteristic of the area. Typically, adjustments for the 30th Highest Hour or other correctional factors are applied to traffic counts on state highways (US 20 and US 97) to reflect the higher traffic volumes that are exhibited during the summer months. The counts are adjusted based on data from Automatic Traffic Recording (ATR) devices maintained on state facilities. The travel demand model does not account for these adjustments. Based on the travel characteristics within and through the BMPO planning area, seasonal variation has a significant impact on the existing and future traffic operations and it should be noted that the model generally underestimates the future forecast traffic volumes for certain peak months throughout the year.

Future Corridor Deficiencies

The Committed Scenario represented the base case for the forecasted 2040 growth. This scenario included transportation system improvements within the BMPO planning area that can be constructed and implemented with the current programmed funding and are identified in the Capital Improvement Plan (CIP) or the Statewide Transportation Improvement Plan (STIP). Figure 6-1 shows the forecasted demand to capacity ratio on roadways within the planning area for the 2040 Committed Scenario. The demand-to-capacity ratios illustrated here are based on raw model outputs that serve as a general guide to identify needs and differ from the volume/capacity (v/c) ratios that are calculated using post-processed traffic volumes and the *Highway Capacity Manual Methodology*¹. As shown, the Committed Scenario transportation system does not have adequate roadway capacity to serve the expected future travel needs. Red roadway segments in Figure 6-1 indicate roadway segments that are over-

¹ 2000 *Highway Capacity Manual*, Transportation Research Board, 2000, Chapter 27.

capacity and do not meet the City or ODOT (0.85 in most of the MPO area) traffic operating standards. The demand-to-capacity ratios exceed 1.0 on multiple key corridors in the study area including:

- Cooley Road (between Boyd Acres Road and 18th Street)
- Reed Market Road
 - between Brookwood Boulevard and Bend Parkway
 - between American Lane and Pettigrew Road²
- US 20
 - between Cooley Road and Empire Avenue
 - between 3rd Street and 15th Street
- US 97
 - between Cooley Road and Butler Market Road
 - between Revere Avenue and Truman Avenue
- 27th Street (between Bear Creek Road and Ferguson Road)
- OB Riley Road (between Mathers Drive and Archie Briggs Road)
- Colorado Avenue (between Simpson Avenue and Broadway Street)
- Neff Road (between 8th Street and Purcell Boulevard)
- 15th Street
 - between Bear Creek Road and Wilson Avenue
 - between Reed Market Road and Desert Wood Drive
- Empire Avenue (Boyd Acres Road and US 20)
 - between US20 and Bend Parkway
 - between 18th Street and Purcell Boulevard
- 18th Street (between Egypt Drive and Empire Avenue)
- Wilson Avenue (between Bond Street and 15th Street)
- Brookwood Boulevard (between Powers Road and Porcupine Road)
- Wall Street (from Revere Avenue to Lafayette Avenue)

² City of Bend TSP street policy #19 prohibits widening Reed Market Road from Century Drive to Bond Street.

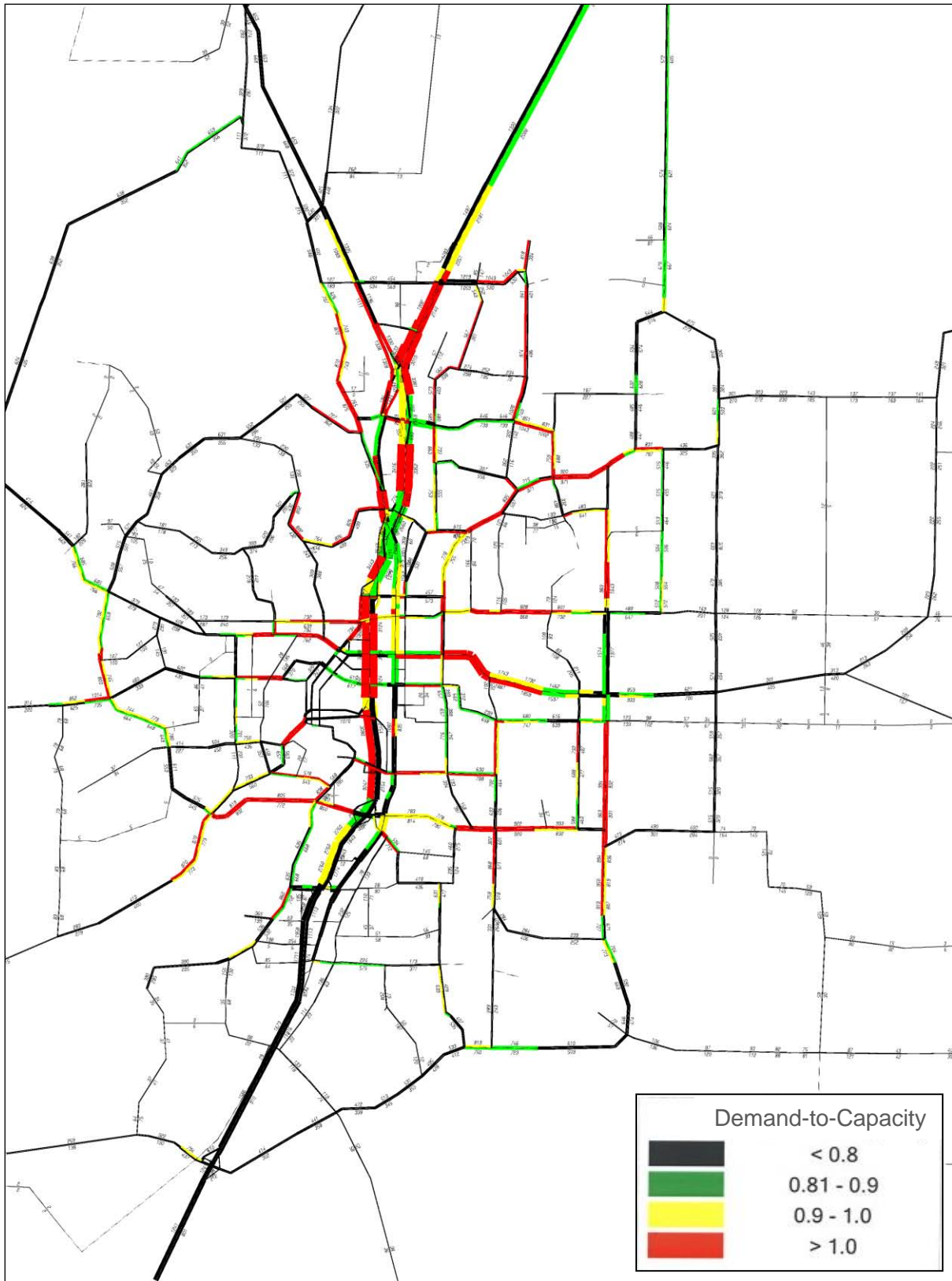


Figure 6-1: 2040 Committed Scenario System Performance Plot

Within the planning area, US 97 and US 20 generally have an operational v/c standard of 0.85. This standard is more stringent than the City's standard. In addition to the red segments shown in Figure 6-1, the green and yellow segments of US 97 and US 20 also fall below the jurisdictional standards. The most congested area on US 20 is generally concentrated between 3rd Street and Purcell Boulevard and does not meet operational standards for a significant portion of the corridor. US 97 also exhibits high congestion levels and does not meet jurisdictional standards for the majority of the corridor between Tumalo Road and Reed Market Road under the 2040 Committed Scenario.

Peak Hour Travel Speeds

PM peak hour travel speeds were also extracted from the future year (2040) model for the Committed Scenario along four corridors including:

- Reed Market Road (Colorado Avenue to Pettigrew Road)
- 27th Street (Butler Market Road to Rickard Road)
- 3rd Street (Greenwood Avenue to Murphy Road)
- US 20 (Old Bend-Redmond Highway to Empire Avenue)
- Greenwood Avenue/US 20 (3rd Street to Providence Drive)

The model output provided average travel speeds by direction of travel. The comparison of travel speeds for existing and future years indicate general deficiencies in the roadway network; reduced travel speeds are attributed to increases in traffic flow. Table 6-4 summarizes the existing travel speeds extracted from the 2010 base model and the future 2040 Committed Scenario for the PM peak hour. Note that while these travel speeds are not post-processed, they still provide an indication of congestion. As shown in the table, the model forecasts travel speeds along the key roadways to decrease by as much as 40% in the future year (2040).

Table 6-4: Corridor Raw Model Travel Speeds³ (PM Peak Hour)

Corridor	2010 (Existing)	2040 (Committed)	% Change
Reed Market Road (eastbound)	37.8 mph	29.5 mph	-22%
Reed Market Road (westbound)	37.8 mph	28.9 mph	-24%
27 th Street (northbound)	42.6 mph	41.1 mph	-4%
27 th Street (southbound)	43.9 mph	37.3 mph	-15%
3 rd Street (northbound)	38.7 mph	38.1 mph	-2%
3 rd Street (southbound)	38.6 mph	33.8 mph	-12%
US 20 (southbound)	49.0 mph	29.4 mph	-40%
US 20 (northbound)	49.3 mph	40.7 mph	-17%

³ Corridor model travel speeds were extracted directly from the MPO travel model and reported without post-processing.

Corridor	2010 (Existing)	2040 (Committed)	% Change
Greenwood (US 20) Avenue (eastbound)	45.5 mph	36.1 mph	-21%
Greenwood (US 20) Avenue (westbound)	46.0 mph	41.5 mph	-10%

Roadway System Improvements

The projected roadway directional volumes were reviewed to identify locations where capacity improvements might be required between intersections. The seven locations identified were:

US 97 from Colorado Avenue to US 20 – through volumes are too high for conventional 4-lane expressway service and a separate refinement plan is needed to examine local capacity improvements and congestion management measures.

Reed Market from Parkway to 27th Street—through volumes are too high for conventional 2-lane arterial service. Currently funded projects (included in the Committed Network) include capacity and intersection improvements along the corridor that should be adequate to handle the demand as a high-capacity 3-lane arterial.

US 97 from US 20 to Cooley Road – through volumes are too high for conventional 4-lane arterial service. The US 97 North Bend Corridor Project is currently underway and will identify a long term solution for this section of US 97. Interim improvements may be possible at the intersections of Cooley Road and Robal Road.

27th Street from Butler Market Road to Rickard Road – through volumes are too high for conventional 2-lane arterial service. Possible capacity improvements include upgrading the arterial to 3-lanes.

Empire Avenue from 3rd Street to Parkway Ramps – through volumes are too high for conventional 3-lane arterial service. Proposed capacity improvements include upgrading to 5-lanes.

18th Street from Empire Boulevard to Cooley Road – through volumes are too high for conventional 2-lane arterial service. Completing the 3-lane arterial improvements should be adequate.

O.B. Riley Road from Glen Vista Road to Archie Briggs Road – through volumes are too high for conventional 2-lane major collector service. Possible improvements include upgrading O.B. Riley Road to a 3-lane, high-capacity collector.

Future Capacity Analysis

The current analysis focuses on applying the travel model to extract system measures such as link capacity and demand. The previous MTP, the Bend TSP, and the Bend SDC analyzed future demand at study intersections within the MPO and provided the guidance for developing an intersection improvement project list. These projects have an estimated cost of \$65 million, are funded by a variety of City sources, and are not included in the current MTP analysis of regionally significant corridors.

Scenario Development

As summarized in the previous section, the Committed Scenario has significant roadway system capacity deficiencies in the future year (2040). Addressing the system deficiencies requires both direct upgrades to roadways and other measures (transit, bicycle/pedestrian improvements, and traffic demand management policies) that are not completely captured in the travel demand model. Future MTP updates may provide more comprehensive motor vehicle analysis including transit, bicycle/pedestrian, and traffic demand management policy impacts.

One preferred build scenario was developed for this MTP Update. The scenario is based on the project list of the previous MTP Preferred 2030 scenario with several refinements to address new system deficiencies caused by updated 2040 land uses and traffic growth. In future MTP Updates, projects will be added and removed from the preferred list based on the evaluation process outlined in the next section. Qualitative measures of effectiveness will be captured by the updated travel model. The result will be financially constrained Preferred Scenario addressing the most important system deficiencies.

A funding analysis⁴ was conducted to determine the available funding resources for transportation capital projects and public transportation operations in the Bend MPO area over the planning period for the MTP (2014-2040). Several road-related funding sources were identified at the federal, state, and local level for the planning period. Total available transportation revenue is \$252.6 million, with \$156.6 million available for roadway projects.

Evaluation Process

Evaluation criteria help guide the selection of future roadway projects within the BMPO planning area and provide qualitative and quantitative measures for each goal category developed at the onset of the planning process. The evaluation criteria are categorized into two levels; the first level of evaluation includes criteria that can be used for general screening purposes and evaluates how well potential projects meet the established goals and policies. The second level of evaluation includes a more detailed system-wide analysis that evaluates specific projects included in the travel demand model. Table 6-5 outlines the first level of recommended evaluation criteria categorized by goal category.

⁴ Bend MTP Revenue Analysis, *ECONorthwest*. August 2014.

The table includes both quantitative and qualitative measures of effectiveness that were considered while developing the future (2040) scenario roadway improvement projects for inclusion in the Preferred Scenario.

Table 6-5: Recommended Evaluation Criteria

Goal Category	Measure of Effectiveness	Type of Criteria
Project Level Criteria		
Mobility and Balance	<ul style="list-style-type: none"> ▪ Demand-to-capacity ratio ▪ Travel speeds ▪ Provides balance of modes of travel 	<ul style="list-style-type: none"> ● ● ○
Safety and Efficiency	<ul style="list-style-type: none"> ▪ Ability to address existing safety issues ▪ Ability to support TSM measures ▪ Supports ITS corridor 	<ul style="list-style-type: none"> ○ ○ ○
Environment and Livability	<ul style="list-style-type: none"> ▪ Impact to environmentally sensitive land ▪ Impact to resource land 	<ul style="list-style-type: none"> ○ ○
Economic Development	<ul style="list-style-type: none"> ▪ Provision for economic revitalization ▪ Supports freight mobility ▪ Supports ITS corridor 	<ul style="list-style-type: none"> ○ ○ ○
Program Level Criteria		
Accessibility and Equity	<ul style="list-style-type: none"> ▪ Ability to provide Transportation Demand Management (TDM) ▪ Connectivity of travel modes 	<ul style="list-style-type: none"> ○ ○
Land Use	<ul style="list-style-type: none"> ▪ Ability to support multi-modal transportation development ▪ Improve street connectivity ▪ Provide alternatives to state route system for local travel 	<ul style="list-style-type: none"> ○ ○ ○
Financially Responsible	<ul style="list-style-type: none"> ▪ Capital cost of alternatives ▪ Opportunity to promote public / private partnership 	<ul style="list-style-type: none"> ● ○

Notes

- = Quantitative (Absolute value from technical methods)
- = Qualitative (Relative value based on judgment)

The previous MTP update used similar evaluation criteria to identify Preferred Scenario projects. The majority of the projects selected for the current Preferred Scenario were identified and evaluated for priority in the previous MTP update.

The Bend MPO travel demand model (developed by TPAU) was used to analyze several quantitative measures. This section describes the system performance measures used to evaluate the different scenarios and presents the results of the overall system wide performance evaluation.

Preferred Scenario

The preferred scenario includes the recommendations for the Bend Metropolitan Transportation Plan for the future year (2040). The Preferred Scenario for the future year was selected based on the system-wide system performance evaluation, the adopted goals and policies and the results of the financial analysis. The Preferred Scenario includes a list of projects that have been prioritized based on the established

evaluation criteria outlined above and the financial constraints of the existing and future budget. The project list includes projects from the previous MTP Preferred Scenario that are still needed to address the future capacity issues throughout the Bend MPO planning area, as well as new projects that were identified to meet system needs. As mentioned previously, the project list only includes projects that have regional significance. All other projects are the responsibility of the City and County for implementation and they are not included in the Bend MTP list of preferred projects.

Some of the collector roadway system deficiencies identified in each of the future scenarios were not addressed in the project lists due to limited minimal impacts to the regional transportation system. The financial analysis that was developed in coordination with the Bend MTP examined revenues for the arterial and collector systems. For the purpose of this regional analysis, a total cost for the collector project list over the MTP time period is included in Table 6-6, though several of the individual projects are not identified.

Table 6-6 summarizes the recommended roadway improvement projects under three jurisdictions: City of Bend, Deschutes County or ODOT. For most projects, the location includes a street segment defined by the street name with the project limits. This list is preliminary and the specific limits and location may be refined as further analysis is conducted and more information is obtained before construction occurs. The projects identified are at the planning level and many of the details were assumed based on the time-frame of construction and may be modified prior to construction. All of the projects identified in the preferred scenario have a project number that is mapped on Figures 6-3 and 6-4. Roadway expansion and extension projects are illustrated in Figure 6-3; intersection improvements and roundabouts are illustrated in Figure 6-4.

The projects were selected and prioritized based on funding availability, the established evaluation criteria, and the impact of the projects within the BMPO planning area. The evaluation criteria were introduced in the previous section and include a series of quantitative and qualitative project level criteria. These criteria are used to prioritize and select projects for the Preferred Scenario.

Table 6-6 outlines the prioritized projects into two categories, short-term and long term. The short-term projects include committed projects that are already funded (including GO Bond) to address needs identified through previous planning and analysis and are expected to occur within the next five years. The long-term projects include projects that will occur more than five years after the plan has been adopted. Prioritization of the projects will be refined through Stage 2 of the MTP Update.

These potential roadway improvement projects are needed to comply with adopted policies and standards within the BMPO area. The project priority listed in the table serves only as a guide for implementation. Changes in development patterns, funding availability and other factors may influence the order that projects are constructed throughout the BMPO planning area.

Table 6-6: Financially Constrained / Preferred Scenario-Project List

Project #	Location (Jurisdiction)	From	To	Improvement	Project Priority	Planning Level Cost (\$1,000s)
1	Reed Market Rd	15 th Street	27 th Street	3 lane collector modernization with bike lanes and sidewalks	Short	Funded
2	Reed Market Rd	15 th Street		Intersection Improvement – will convert from signal to partial multi-lane roundabout	Short	Funded
3	Reed Market Rd	American Lane		Re-align American Lane (straighten road and add traffic signal at Reed Market intersection)	Short	Funded
4	Reed Market Rd	4 th Street	15 th Street	3 lane collector modernization with bike lanes and sidewalks	Short	Funded
5	Murphy Rd Phase 1			Re-align Murphy Rd, Murphy overcrossing US 97, hwy access modifications, Murphy/3 rd roundabout	Short	Funded (under construction)
6	New E-W Collector	Brosterhous Rd	American Lane	New 2 lane road	Short	Funded
Total Short-Term Project Cost (projects 1-6): Funded						
7	Empire Avenue	3 rd Street	US 97 NB ramps	Widen to 5 lanes and install signal at SB ramps	Long	\$3,900
8	Empire Avenue	Purcell Boulevard	27 th Street	Construct 2 lane extension	Long	\$6,700
9	Reed Market Road (Bend)	27 th Street Intersection		Re-align Stevens Road to connect directly to Reed Market Road	Long	\$4,700
10	O.B. Riley Road	Empire Avenue Intersection		Construct intersection control improvements	Long	\$1,900
11	Murphy Road	Brosterhous Road	15 th Street	Construct 2 lane extension	Long	\$11,375
12	US 97/Cooley Road area improvements	Cooley Road		Various intersection and lane upgrade improvements	Long	\$30,000
13	Empire Ave (Bend)	US 97 NB off-ramp		Widen existing ramp to 2 lanes	Long	\$3,000
14	US 97	Powers Road Intersection		Preliminary engineering and ROW acquisition for overcrossing or interchange	Long	\$6,500
15	US 20 (Greenwood Avenue)	4 th Street Intersection		Install traffic signal	Long	\$413

Project #	Location (Jurisdiction)	From	To	Improvement	Project Priority	Planning Level Cost (\$1,000s)
16	Yeoman Road	18 th Street	Existing section	Construct 2 lane extension	Long	\$1,009
17	North frontage road	Murphy Road	Powers Road	New 2 lane road	Long	\$5,400
18	South frontage road	Murphy Road	Parkway off-ramp	New 2 lane road	Long	\$13,800
19	Britta Street (north section)	Robal Road	Empire Avenue	New 2 lane road extension	Long	\$1,000
20	Britta Street	Ellie Lane	Halfway Road	New 2 lane road extension	Long	\$2,000
21	Purcell Boulevard	Holiday Ave (south)	Holida Avenue (north)	New 2 lane road extension	Long	\$2,288
22	Mervin Samples Road – Sherman Road	O.B. Riley Road	Empire Avenue	Upgrade to 2 lane collector roadway and install traffic signal at US 20	Long	\$6,100
23	O.B. Riley Road	Glen Vista Road	Archie Briggs Road	Upgrade to 3 lane arterial	Long	\$6,700
24	27 th Street	Bear Creek Road	Ferguson Road	Upgrade to 3 lane arterial	Long	\$11,500
25	US 97	Murphy Road		Construct northbound on and southbound off ramps	Long	\$6,100
26	18 th Street	Cooley Road	Empire Avenue	Complete 3 lane arterial corridor	Long	\$6,100
42	US 20	Cooley Road		Construct intersection control improvements	Long	\$1,600
45	US 20	Cooley Road	3 rd Street	Add second southbound through lane	Long	\$4,800
46				Other future local transportation projects	Long	\$19,678
Total Long-Term Project Cost (projects 7-26, 42, 45, and 46):						\$156,563
						TOTAL COST: \$156,563

**The project cost estimates include right-of-way costs.*

Scenario Model Evaluation

Each model scenario was used to evaluate the impacts of the scenarios on the regional transportation system. These criteria are most relevant during the initial stages of project development for general screening purposes and planning purposes. The criteria have been refined by the BMPO and are used to determine the projects to be selected for inclusion in the plan.

Figure 6-2 shows the forecasted demand to capacity ratio on roadways within the planning area for the 2040 Preferred Scenario.

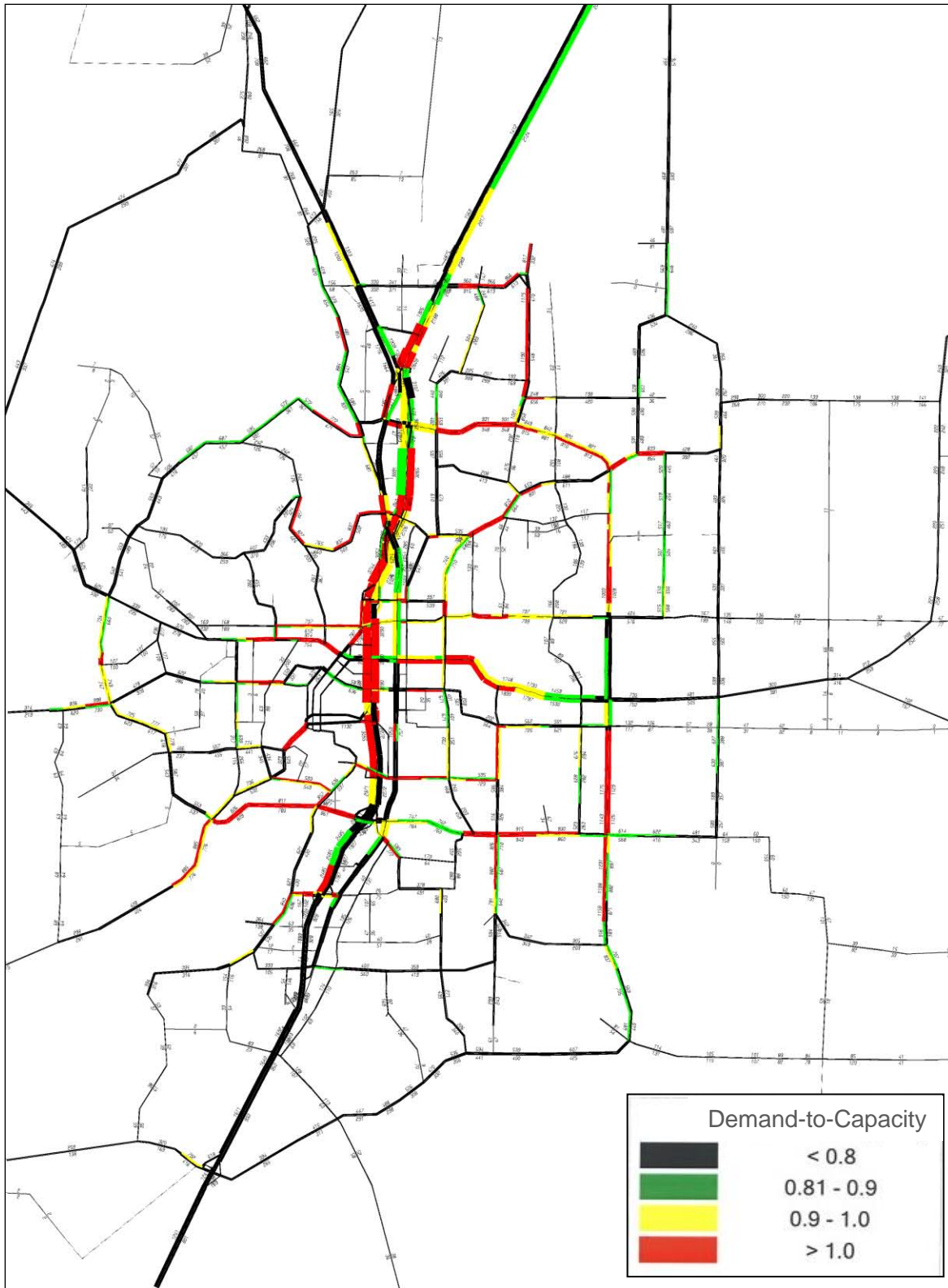


Figure 6-2: 2040 Preferred Scenario System Performance Plot

A system-wide evaluation for the future year (2040) of the BMPO planning area was conducted on the model data. The evaluation criteria and results are discussed below.

- **Vehicle Miles Traveled (VMT) during the PM peak hour** -- This measure evaluates the total miles traveled by all vehicles over a selected transportation corridor or over the entire system within the predicted future MPO boundary during the PM peak hour.
- **Vehicle Hours Traveled (VHT) during the PM peak hour** -- This measure evaluates the total hours traveled by all vehicles over a selected transportation corridor or over the entire system within the predicted future MPO boundary during the PM peak hour.
- **Total Lane Miles** -- This measure evaluates the length of driving lanes multiplied by the number of driving lanes for the total transportation roadway network within the predicted future MPO boundary.
- **Demand/Capacity Ratio** -- The measure of congestion can be measured by the demand/capacity ratio which determines the ratio of vehicles over the capacity of a roadway. The travel demand model has the capacity of evaluating the overall flow of traffic over the length of a specified corridor. D/C ratios that are higher than 0.80 affect driving decisions due to the presence of other vehicles. A D/C ratio of 1.0 indicates significant congestion.
- **Number/Percentage of Congested Lane Miles during the PM peak hour** -- Congestion on the roadway network is defined by a threshold of the demand over capacity ratio. The number and percentage of lane miles that operate with a D/C ratio over 0.80 are characterized by “congested conditions”. The level of congestion can also be determined by a scale of D/C ratios that include free flow, moderately congested, and congested.
- **Travel times during the PM peak hour** -- Traffic flow can be measured by computing the time it takes to complete a trip during the PM peak hour (which is typically the most congested period of the day). The measure can be determined for specific corridors or the average for the entire planning area transportation system

The following tables (Table 6-7 thru Table 6-10) compare numerous evaluation measures that were calculated from the base year (2010) and future year (2040) model output. The evaluation of the scenarios refined the selection of the Preferred Scenario. Note that all measures are calculated for the roadway system within the predicted future MPO boundary, with the exception average travel time. Average travel time is calculated over the entire system for all trips beginning and/or ending within the predicted future MPO boundary.

Table 6-7: MPO System-wide Performance Measures (PM Peak Hour)

PM Peak Hour Performance Measures	EXISTING	FUTURE	
	Base Year (2010)*	Committed (2040)	Preferred (2040)
City of Bend Facilities			
Vehicle Miles Traveled (VMT)	59,256	112,017	111,703
Vehicle Hours Traveled (VHT)	1,162	3,419	3,342
Deschutes County Facilities			
Vehicle Miles Traveled (VMT)	4,587	13,241	13,356
Vehicle Hours Traveled (VHT)	107	299	299
ODOT Facilities			
Vehicle Miles Traveled (VMT)	44,353	69,391	71,210
Vehicle Hours Traveled (VHT)	941	1,814	1,698
Total (All Facilities)			
Average Travel Time (minutes)	7.20	8.65	8.35
Vehicle Miles Traveled (VMT)	108,196	194,649	196,269
Vehicle Hours Traveled (VHT)	2,660	5,532	5,339

*For the base year, all measures were calculated based on the existing MPO boundary.

Table 6-7 outlines critical evaluation measures such as the peak hour average travel time, vehicle miles traveled and vehicle hours traveled for City of Bend, Deschutes County and ODOT facilities. These measures are quantitative measures that are typically used to evaluate the transportation network and effectively indicate future travel patterns compared to the base year (2010) and future year Committed Scenario (2040) and the Preferred Scenario (2040). The Preferred Scenario improves system-wide operations by improving (decreasing) VHT by over 3% from the Committed Scenario while maintaining approximately the peak VMT (<1% difference). The average travel times for the PM peak hour increase by 20% from the Base Scenario to Committed Scenario, while the Preferred Scenario provides a 3% improvement over the Committed Scenario.

Table 6-8: Percentage of Congested Lane-Miles (PM Peak Hour)

	EXISTING	FUTURE	
	Base Year (2010)	Committed (2040)	Preferred (2040)
City of Bend Facilities			
Total Lane Miles	246	267	272
Congested Lane Miles	15	80	72
% of Congested Lane Miles	6%	30%	26%
Deschutes County Facilities			
Total Lane Miles	42	49	47
Congested Lane Miles	0	3	4
% of Congested Lane Miles	0%	6%	9%
ODOT Facilities			
Total Lane Miles	68	75	83
Congested Lane Miles	11	41	34
% of Congested Lane Miles	16%	55%	41%

Note: Congestion defined as model links with demand/capacity ratio ≥ 0.80
 ODOT operational standard: $v/c = 0.80$

Table 6-8 illustrates a similar trend of evaluation results; the Preferred Scenario has the most significant effects on the future roadway network. There are more total lane miles due to the number of roadway extension and expansion projects, but the percentage of congested lane miles decreases by 4% for City of Bend and 14% for ODOT facilities with the Preferred Scenario improvements.

Table 6-9 and Table 6-10 provide a summary of future year (2040) congested conditions. D/C ratios that are greater than 1.0 indicate congested conditions on the roadway network. The City of Bend maintains the highest percentage of roadway facilities within the BMPO planning area.

Table 6-9: Percentage of Total Lane Miles by Demand/Capacity Ratio (PM Peak Hour)

Demand/ Capacity Ratio	EXISTING		FUTURE			
	Base Year (2010)		Committed (2040)		Preferred (2040)	
	Lane Miles	%	Lane Miles	%	Lane Miles	%
City of Bend Facilities						
0.0-0.59	207	84%	146	55%	156	57%
0.60-0.69	12	5%	19	7%	22	8%
0.70-0.79	12	5%	22	8%	22	8%
0.80-0.89	7	3%	24	9%	20	7%
0.90-0.99	6	2%	22	8%	23	8%
≥1.0	2	1%	34	13%	29	11%
Total	246	100%	267	100%	272	100%
Deschutes County Facilities						
0.0-0.59	42	100%	38	78%	35	74%
0.60-0.69	0	0%	4	8%	5	11%
0.70-0.79	0	0%	4	8%	3	6%
0.80-0.89	0	0%	1	2%	3	6%
0.90-0.99	0	0%	1	2%	0	0%
≥1.0	0	0%	1	2%	1	2%
Total	42	100%	49	100%	47	100%
ODOT Facilities						
0.0-0.59	40	59%	22	29%	30	36%
0.60-0.69	11	16%	8	11%	10	12%
0.70-0.79	6	9%	4	5%	9	11%
0.80-0.89	9	13%	12	16%	9	11%
0.90-0.99	1	1%	10	13%	12	14%
≥1.0	1	1%	19	25%	13	16%
Total	68	100%	75	100%	83	100%

As shown in Table 6-9, ODOT facilities exhibit a higher percentage of congested roadway conditions for the PM peak hour for each of the future year (2040) scenarios (indicated by D/C ratios greater than 0.80). According to the model analysis, the Preferred Scenario provides congestion improvement over the Committed Scenario on both City and State facilities. The Preferred Scenario congestion mitigations are especially effective on State facilities, increasing uncongested lane-miles from 29% to 37% while decreasing congested lane-mile from 25% to 16%. Preferred Scenario capacity improvements to parallel routes (e.g., O.B. Riley Road) allow state facility traffic to shift to other routes, decreasing state highway congestion.

Table 6-10: Percentage of VMT by Demand/Capacity Ratio (PM Peak Hour)

Demand/ Capacity Ratio	Existing		Future			
	Base Year (2003)		Committed (2040)		TSP (2040)	
	VMT	%	VMT	%	VMT	%
City of Bend Facilities						
0.0-0.59	35,029	59%	28,247	25%	30,592	27%
0.60-0.69	6,045	10%	9,906	9%	11,159	10%
0.70-0.79	7,061	12%	12,622	11%	13,075	12%
0.80-0.89	5,099	9%	16,155	14%	13,695	12%
0.90-0.99	4,680	8%	16,136	14%	17,357	16%
≥1.0	1,342	2%	28,951	26%	25,825	23%
Total	59256	100%	112017	100%	111703	100%
Deschutes County Facilities						
0.0-0.59	4,401	96%	6,864	52%	5,877	44%
0.60-0.69	0	0%	1,736	13%	2,451	18%
0.70-0.79	0	0%	2,285	17%	2,014	15%
0.80-0.89	0	0%	1,025	8%	1,937	15%
0.90-0.99	0	0%	844	6%	261	2%
≥1.0	186	4%	486	4%	816	6%
Total	4587	100%	13240	100%	13356	100%
ODOT Facilities						
0.0-0.59	18,969	43%	11,031	16%	24,781	35%
0.60-0.69	8,449	19%	6,907	10%	9,930	14%
0.70-0.79	5,236	12%	3,396	5%	7,422	10%
0.80-0.89	8,891	20%	12,327	18%	8,013	11%
0.90-0.99	1,887	4%	10,860	16%	10,668	15%
≥1.0	921	2%	24,870	36%	10,396	15%
Total	44,353	100%	69,391	100%	71,210	100%

As noted previously, the Preferred Scenario has a higher number of total lane miles due to a number of roadway projects modeled in the scenario, but it still yields a lower percentage of congested vehicle miles traveled compared to the Committed Scenario.

Another system-wide performance measure that was evaluated includes link speeds through the transportation network. PM peak hour speeds were extracted from the future year (2040) model for the Committed and Preferred Scenarios along three select corridors including:

- 27th Street (Butler Market Road to Rickard Road)
- US 20 (Old Bend-Redmond US to Empire Avenue)
- Greenwood Avenue/US 20 (3rd Street to Providence Drive)

Table 6-11 summarizes the PM peak hour speeds along these corridors. Compared to the Committed Scenario, the speeds along the corridors increase for the Preferred Scenario and indicate that the roadway improvement projects improve the operations on these specific corridors. Travel speeds represent one system-wide measure of evaluating the changes to the roadway network and comparing differences between each scenario.

Table 6-11: Future (2040) Corridor Speed Summary (by direction)

Corridor	Committed	Preferred	Change
	<i>Speed (mph)</i>	<i>Speed (mph)</i>	<i>(%)</i>
27 th Street (northbound)	41.1	42.8	4%
27 th Street (southbound)	37.3	38.7	4%
US 20 (southbound)	29.4	41.6	41%
US 20 (northbound)	40.7	48.8	20%
Greenwood Avenue (eastbound)	36.1	38.0	5%
Greenwood Avenue (westbound)	41.5	42.3	2%

Illustrative Project List

Although the majority of projects included within this plan have reasonable funding, most of the projects identified were of regional significance but did not address many deficiencies on the state systems. The long-term facility needs for several sections along both US 97 and US 20 have been a focus of past and ongoing planning studies. Outcomes from these studies include projects (not yet funded) to improve highway operations on the state systems within the Bend MPO.

In 2007, ODOT and FHWA began the Environmental Impact Statement (EIS) for the US 97 Bend North Corridor Project to provide and plan for a safe, affordable, long term traffic solution for US 97 at the north end of Bend. Project improvements in the vicinity of Empire Avenue have identified funding and are currently listed in Table 6-6. Other improvements associated with the US 97 Bend North Corridor Project, including the extension of 3rd Street, do not have identified funding and are included in the Illustrative Project List, Table 6-13.

Given current funding trends for state facility improvements, any new state projects would require a fundamental change in funding opportunities and priorities to achieve many of them. The cost of these added improvements on state facilities are very significant and it is expected that they will require a local match to implement. Moving projects to the fiscally constrained list over time and the impact on the MTP budget will need to be addressed through future plan amendments.

An illustrative list of potential new state facility projects was developed, as summarized in Table 6-12, that will serve as placeholders until the various planning studies and environmental reviews have been completed to provide better definition of the scope and scale of anticipated projects. As more funding becomes available, the Bend MPO would consider the implementation of these projects.

Table 6-12: Illustrative Project List for State Facilities

Project Description	Limits	Estimated Cost
US 97 Bend North Corridor Improvements	Bend Northern UGB to Empire Avenue	\$120-\$180 million
US 97 Corridor Improvements	Empire Avenue to Colorado Avenue	Unknown
US 20 Corridor Improvements	3rd Street to 27th Street	Unknown
US 20 North Corridor Improvements	Tumalo Road to Empire Avenue	Unknown
US 20 grade separated improvements	At Cook Avenue/O.B. Riley Road	Unknown

Additional projects from the previous MTP Preferred Scenario or other local agency planning efforts were not included in the Preferred Scenario due to funding constraints. Some of these projects still provide regional connectivity and in some cases congestion relief either by adding lanes or providing alternate routes. Therefore, the project list provided in Table 6-13 summarizes these projects, providing additional guidance to the MPO should more funding become available over the next 25 years. Note that as these projects are not part of the Preferred Scenario they are not included on the project maps (Figures 6-3 and 6-4), nor the model system measures.

Table 6-13: Additional Illustrative Projects

Project #	Location (Jurisdiction)	From	To	Improvement	Estimated Cost (\$1,000s)
27	Cooley Road	18 th Street	Deschutes Market Road	Construct 3 lane road extension	\$11,867
28	Hunnell Road	Cooley Road	Rodgers Road	Construct new 2 lane road	\$8,000
29	Yeoman Road	Deschutes Market Road	Butler Market Road	Construct 2 lane road extension	\$1,688
30	South frontage road	Ponderosa Street	Baker Road	Construct new 2 lane road	Unknown

Project #	Location (Jurisdiction)	From	To	Improvement	Estimated Cost (\$1,000s)
31	Murphy Road	15 th Street	Rickard Road	Construct new 2 lane road extension	Unknown
32	Cooley Road	O.B. Riley Road	O.B. Riley Road	New 2 lane road loop extension	\$10,863
33	Putnam Road/Tumalo Road	City UGB	Johnson Market Road	Construct new 2 lane road	Unknown
34	Skyline Ranch Road	Shevlin Park Road	Skyliners Road	Construct new 2 lane road	\$11,000
35	Summit Drive	Mt Washington Drive	Skyline Ranch Road	Construct new 2 lane road	\$5,000
39	New E-W collector	27 th Street	Hamby Road	Construct new 2 lane road	Unknown
40	Central Area MMA Improvements			Intersection control improvements and local street network enhancements	Unknown
41	Colorado	US 97 Parkway NB Ramps		Construct intersection control improvements	\$3,400
43	Purcell Boulevard	Cooley Road	Yeoman Road	Construct 2 lane road extension	\$4,731
44	Robal Road	US 97 (Parkway) intersection		High capacity intersection improvement	\$4,800
47	US 97	Powers Road Intersection		Complete construction of interchange or overcrossing	\$13,500

Further Study/Additional Analysis

The projects listed in Table 6-6 address many of the corridor deficiencies that were identified for the future year (2040) within the Bend MPO planning area. Some of the identified deficiencies (based on ODOT's, City of Bend's and Deschutes County operational standards) were either not addressed or not completely resolved with the Preferred Scenario project list. The following corridors still contain highly congested (D/C>1.0) segments in the Preferred Scenario that exceed the likely peak hour capacity on those corridors.

- US 20 – partially improved
- US 97 – partially improved

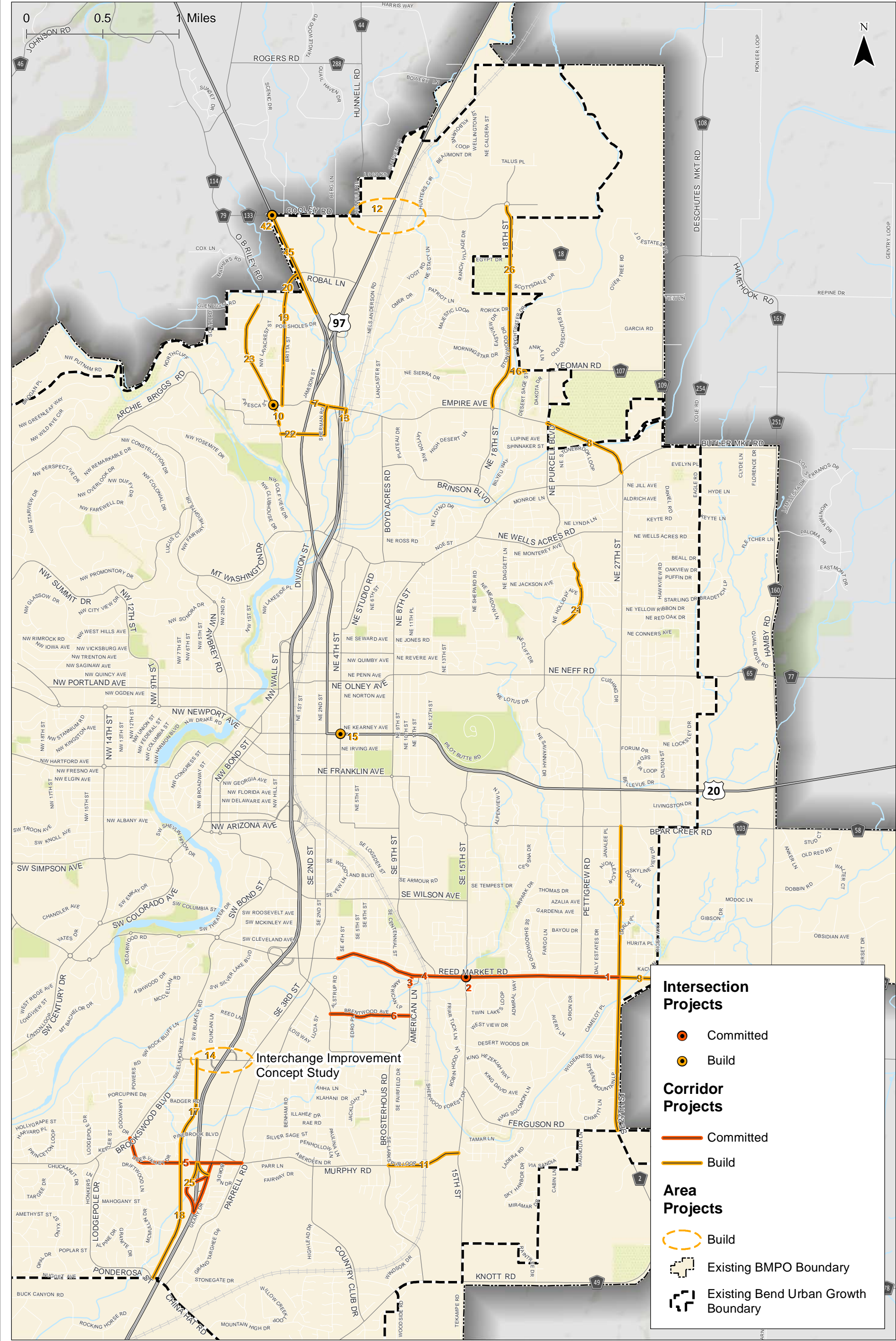
Several of the illustrative projects address the issues on these corridors, either by moving demand to alternate routes or improving capacity on existing routes. Future updates to the MTP may refine the corridor analysis, using intersection operational

measures to better capture project impacts and determine if additional corridor capacity is justified.

Several segments were identified on US 97 that will not meet operational standards in the future year. The Average Daily Traffic (ADT) volumes along this four-lane facility for the future year (2040) are projected to be between 45,000–50,000 vehicles⁵ per day. The high traffic volumes along the Bend Parkway and US 97 were not directly addressed in this MTP Update. Additional north-south capacity, in the form of parallel local improvements, and other management strategies should be considered in a future US 97 Parkway Refinement Study. The on-going Bend Urban Growth Boundary (UGB) Expansion Study also includes the analysis of several different alternative roadway networks, including a network of arterial and collector improvements on the east side of Bend. This network will be evaluated further and included as part of future MTP updates, along with other findings and recommendations from the UGB Expansion study.

There are numerous other highway segments that will not meet ODOT's mobility standards by the MTP's horizon year of 2040, consequently there will need to be additional analysis of options to address these deficiencies. Given the constraints and high costs which would be needed to provide sufficient capacity improvements to meet mobility standards, Transportation System Management (TSM) options such as access management and ramp metering may be considered. Alternate mobility standards may be considered for highway sections, but this will require additional evaluation and approval by ODOT.

⁵ Based on 2040 travel demand model output.



Committed and Build Roadway Improvements
Bend, Oregon

Figure
6-3

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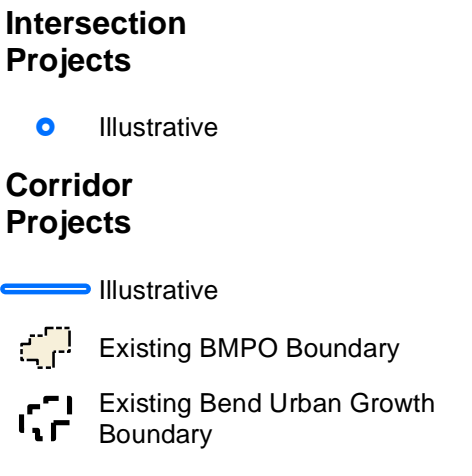


Figure 6-4

Chapter 7: Pedestrian and Bicycle System

Introduction

Pedestrian and bicycle facilities are integral elements of the transportation system and valuable components in the strategy to reduce reliance on automobiles. The community benefits in many ways from adequate pedestrian and bicycle facilities including reducing traffic congestion, supporting tourism, improving public health, and providing accessibility to all parts of the community. Further, there is a segment of the population who do not drive or who do not have access to an automobile.

Trip Potential

Travel by bicycle and foot has tremendous potential in the Bend urban area. A large part of this is attributable to the region's predominantly sunny weather and relatively flat terrain. In addition, the outdoor spirit of the citizenry, the desire to engage in healthy exercise, and the interest in active modes of travel provide a strong population base for generating non-automobile trips. The visibility of pedestrian and bicycle traffic throughout the year confirms the importance of these travel options.

Bend's relatively small size is amenable to travel by bicycle or foot. Depending on the type of trip, studies indicate a willingness of people to walk between a quarter and a half mile, and bicycle upwards of 2 or 3 miles. In 2006, the Oregon Department of Transportation (ODOT) funded the *Individual Transportation Options Pilot Project*. The project evaluated the transportation behavior of a random sample of persons in Bend. The results of the project showed that 16 percent of all automobile trips are one mile or less and 56 percent are three miles or less. These data suggest that many trips could possibly be made on bicycle or on foot.

Year 2012 ACS 5-year estimates data shows that approximately 1.7-percent of workers in the MPO area commuted to work by bicycle, while about 2.6-percent walked to work. Throughout the MPO area, travel time to work by all modes was less than fifteen minutes for about 47-percent of all workers, less than ten minutes for 23-percent, and less than five minutes for 5-percent. Short trip lengths and travel times are part of the equation for encouraging non-auto trips. A complete and safe network of trails, sidewalks and bicycle facilities will further encourage these trips.

The year 2012 US Census American Community Survey (ACS) data show that approximately 4.4-percent of households in the Bend metropolitan area do not have access to an automobile.

Benefits

In addition to reducing traffic, non-motorized trips conserve fossil fuels, reduce noise, protect air and water quality, reduce the demand for parking spaces, and improve personal health. The air quality issue is particularly important to Central Oregonians, as the pristine mountain views and clean air are cherished resources of the community. A

concerted effort to reduce automobile trips and the resultant exhaust emissions will be valuable in diminishing the impact on air quality. Non-motorized trips can also directly address the obesity crisis facing the United States. Getting people to walk or bicycle directly benefits personal health.

Community and Site Design

An adequate bike and pedestrian system requires a complete network of walkways and bikeways that connect parks, schools, and activity centers. Orienting buildings to the street and providing safe and easy connections from stores to the sidewalk, and providing convenient bike parking all help make bicycling and walking more desirable trip choices. The city has a strong development code that requires quality walking and biking systems and requires lot designs to encourage walking and biking through walkways, building orientation, and on-site bike parking.

Facility Performance Analysis

The quality of walk and bike facilities should be considered in evaluating the adequacy of the system. The current draft of Version 2 of the Oregon Department of Transportation's (ODOT's) Analysis Procedures Manual (APM) notes that there are multiple analyses procedures that can be used for this purpose, depending on the scale of the analysis being conducted (i.e. network level vs. individual segment). These methods attempt to capture how bicyclists and pedestrians will perceive the quality of the biking or walking facility. At the regional level, the APM recommends using its Qualitative Assessment method, which is a simplification of the *Highway Capacity Manual* (HCM) 2010's multimodal level-of-service (MMLOS) procedures into subjective categories (i.e. Excellent, Good, Fair, Poor) for planning purposes. This procedure can be applied for both pedestrian and bicyclist networks. Level of Traffic Stress (LTS) can also be used for analyzing bike networks at a regional level, but is not applicable to pedestrian facilities. LTS divides routes into four different stress categories, which are defined as being suitable for different user groups (e.g. children to advanced riders) based on the opinions of the method's authors. For more detailed analysis at the project level, the APM recommends using the full MMLOS procedures from the HCM 2010. The full version of MMLOS requires more detailed inputs than the other methods, providing the opportunity to assess the impacts of detailed changes. The final version of the APM will also include an intermediate analysis procedure, currently expected to be a simplified version of MMLOS that is more detailed than the Qualitative Assessment methodology.

Maintenance and Repair

Maintenance and repair of the bicycle and pedestrian system are critical to the use of these transportation modes. Timely snow removal, sweeping, gravel removal, patching, surface repair and striping are all necessary to maximize the use of bike lanes and sidewalks. Property-tight sidewalks may require less maintenance than curb-tight sidewalks because the landscape strip provides a place to pile snow and separates the sidewalk from road debris accumulation.

In general, responsibility for sidewalk maintenance and repair is assigned to the adjacent property owners. This system may not adequately assure timely maintenance and repair of the sidewalk network. Furthermore, there is no program in place to require the property owners to perform their duties.

The use of gravel during winter months can negatively impact the bicycle lane and pedestrian system. The city of Bend has implemented a street sweeping system that helps remove the gravel as soon as weather conditions allow. Chip sealing can also have a negative impact on bicycle safety. The city of Bend and Deschutes County have worked with the Deschutes County Bicycle and Pedestrian Advisory Committee in recent years to minimize the impacts of chip sealing on the bicycle system.

The Pedestrian System

Walking is the most basic form of transportation, undertaken by almost every citizen. Sidewalks and other pedestrian facilities are an essential element of the transportation system since every trip involves at least one walking segment. The City of Bend has been designated a silver-level Walk Friendly Community by the national Walk Friendly Communities Program administered by the Pedestrian and Bicycle Information Center at the University of North Carolina. The City was lauded in particular for the overall existing connectivity of the pedestrian system, for having a development code that encourages short block lengths and connected pedestrian facilities, and for its parking management strategies.

Existing and Proposed Pedestrian System

The existing sidewalk system is delineated in Figure 7-1. This figure is based on an inventory of sidewalks maintained by the City of Bend. The figure reflects the latest inventory data as of 2014, which includes completion of many sidewalk projects that occurred after the *Bend Urban Area Transportation System Plan* was developed. Therefore, Figure 7-1 shows a more extensive complete sidewalk network than the *Bend Urban Area TSP*.

The City has been working on an update of the sidewalk gap prioritization process, which is summarized below in the Ongoing Plans and Programs section, as part of the *Strategic Implementation Plan for Walking and Biking Infrastructure*. Phase II of the MTP Update will incorporate these projects into the 2040 MTP. Chapter 6 of this MTP identifies the committed and build projects for the City. Although some of the identified projects are new roadways or roadway upgrades, which will include a sidewalk component, the majority of pedestrian facility projects will be covered under the funding allocated for the City of Bend local transportation projects.

Pedestrian System Components

Sidewalks

Because the primary function of sidewalks is to provide a safe place for pedestrians, facilities need to be designed accordingly. Sidewalks also need to be constructed to Americans with Disabilities Act (ADA) requirements. The requirements are meant to insure that everyone, regardless of mobility issues, can safely travel on sidewalks.

In the city of Bend, sidewalk construction has been required in all new residential and commercial developments since the late 1980s. Sidewalks are normally located on both sides of the street and separated from the street by a curb and a landscape strip. In steep topography or unusual topography, sidewalks may be allowed on only one side of the street and may be curb-tight. Sidewalks are normally constructed with a concrete material although special paver blocks may be utilized in high-use pedestrian areas, such as downtown Bend, to enhance surface aesthetics. Sidewalks vary in width depending on anticipated pedestrian volumes but have certain minimum widths established to meet ADA requirements. Minimum sidewalk widths are established in the implementing ordinances of the city and county.

Landscape Strip

The area located between a sidewalk and the curb serves many important functions and is commonly referred to as the planting or landscape strip. The landscape strip creates space for a variety of underground utilities, such as telephone, cable television, fiber optic cables, etc. The landscape strip is also beneficial for locating utility poles, fire hydrants, benches, bus shelters, and other features that might otherwise block or obstruct pedestrian travel along sidewalks.

Landscaping helps to soften the hard edge created by pavement and curbs. Large trees can also provide cooling summer shade for parked cars and pedestrians. A canopy of street trees can help to slow traffic and enhance the beauty of the community. The physical separation from the street also improves the design of sidewalks by maintaining a constant grade without dipping at driveways and makes Americans with Disabilities Act compliance easier. During winter months, snow can be plowed into these areas from the street and gravel can accumulate in the parkstrip and not block sidewalks. The landscape strip provides a physical separation from the adjacent roadway, providing enhanced pedestrian comfort and an improved walking experience.

Street Crossings

Crossing local street intersections is normally not difficult because of lower traffic volumes and because the distances are relatively short. Crossing arterial streets can be more challenging based on street width, traffic volume, and speed. Minimizing crossing distances required for pedestrians is important to reduce the actual and psychological barrier created by wide streets and the amount of exposure to conflicting motor vehicle traffic. Increasing driver yielding rates to pedestrians is important and can be done through various design techniques as well as enforcement and education.

Construction of curb extensions is one method to improve the visibility of pedestrians and reduce the crossing distance of the street. These extended “bulb-outs” add valuable pedestrian space, increase driver yielding and reduce the size of the gap needed in traffic. The additional space can also provide a location for bike parking or other sidewalk amenities. Downtown Bend is an excellent example of where this type of design has been used very successfully.

Another solution to addressing conditions where traffic volume is high, or roadways are wide, is the construction of raised medians, islands or refuges. Medians can significantly improve pedestrian visibility, increase driver yielding, reduce the size of the gap needed in traffic, and provide a place to wait for safe gaps in the traffic stream while crossing busy roadways. Medians can also improve the aesthetics of a community with added landscaping opportunities. Islands and refuges are especially important at large intersections to reduce the crossing distance and improve pedestrian comfort by minimizing exposure to motor vehicles.

One important function of traffic signals is providing for the movement of pedestrians across busy intersections. Signal timing and intersection design play a critical role in safety. The city’s recent crash review did find that people crossing at traffic signals were hit by automobiles during the walk phase when permitted turns were allowed. Injuries are more likely when speeds of the turning traffic are higher. Slowing turning traffic can help reduce crashes and injuries. Where truck movements occur and need to be accommodated some techniques to keep the radii tight while still accommodating trucks include: allowing trucks to use both lanes; adding bike lanes to increase the usable radius; or adding truck aprons on the outside. Other techniques to accommodate trucks and pedestrians can include building a dedicated turn lane with a raised island for pedestrians. This significantly improves the comfort of pedestrians by reducing the amount of uninterrupted pavement to cross.

Roundabouts can play a similar role in providing for the movement of pedestrians across busy intersections. Pedestrian safety at roundabouts is well documented. Roundabout design is critical to pedestrian safety by keeping speeds low at the crosswalk, providing pedestrian refuges, and ensuring lighting and visibility are maintained.

Rural Walkways

In sparsely populated areas, the shoulders of rural roads can be designed to also accommodate pedestrians. Pedestrian demand can change in rural areas over time as development occurs. Pedestrian demand can also exist in rural areas near commercial strips or in residential clusters along county roads or state highways.

Neighborhood Accessways

An August 2006, report provided an assessment of the city of Bend’s neighborhood accessways. The neighborhood accessway system is comprised of a wide range of facilities that include a variety of trail types and on-street facilities that are collectively referred to as “accessways.”

The purpose of these facilities is to minimize travel distances within and between residential areas and commercial centers, major employment areas, transit stops, or within and between nearby neighborhood activity centers such as schools and parks. The greater system of proposed accessways will provide transportation and recreation mobility opportunities for non-automobile travel through out the community. This accessway plan for the City generally uses a geographic spacing for accessways on an interval of approximately every *quarter-mile*.

Multi-Use Trails

Trails provide important transportation connections and shortcuts to destination points that make travel by foot or bicycle comfortable, pleasant, and convenient. Recreational activity is also a common use of the trail system, with scores of residents and tourists using these areas for walking, jogging, bicycling, and other activities.

Trails also provide citizens and visitors with links to the natural environment. One special quality of a trail is the opportunity they provide to escape the bustle of the city - while remaining within the city. This is particularly evident along the Deschutes River trail system. Public opinion supports this sentiment, as people cite the ability to depart from traffic congestion, noise, and exhaust as a prime factor in their enjoyment of trails.

The first trail plan in the area was established in the Bend Area General Plan in 1981. This has been the policy tool that has provided some protection of trail corridors and has promoted the construction of the current limited system. Several additions were adopted by the City and County and incorporated into the General Plan in 1998. The current “primary” trail plan is illustrated in the City of Bend Transportation System Plan (Bicycle and Trail System Map). The city of Bend and the Bend Metro Park and Recreation District continue working together to plan and develop a trail system to meet the recreational and transportation needs of the community.

The trail plan for the City of Bend is delineated on figures 7-1 and 7-2. The alignments depicted as proposed were based on the City’s TSP should be considered general in nature. Flexibility should be permitted during the development and design of private lands to locate these planned primary trails to fit the context of the natural terrain, to minimize trail grade, to consider street crossings and other safety issues, to account for the pattern and design of the development, or consider any other topographic or geographic barriers or issues, etc. Also, while it may be suitable to locate a trail next to a street due to existing difficult to resolve issues, it is the intent of the plan to locate trails - as much as possible - away from streets to minimize conflicts with other types of conflicting traffic. It is also the intent of the trail system (both connector and primary) to provide direct and convenient walking and bicycling connections to parks, schools, open spaces, employment areas, shopping destinations, and the like. Balancing these trail design criteria may require a concerted coordination effort between the City, the Park District, and new development to satisfactorily locate these trails to ensure that the intent of the plan will be fulfilled.

Railroad Right-of-way Trails

Both “abandoned” and “active” railroad right-of-ways can be developed as part of local trail systems. The Springwater Trail in the Portland area and the bikepath in Ashland along the Central Oregon and Pacific rail line are excellent examples of this type of trail development that is located along an active railroad right-of-way within the State of Oregon. The report *Rails-with-Trails - Lessons Learned 2002*, prepared for the U.S. Department of Transportation, provides a comprehensive analysis and evaluation of rails with trails (RWT) development practices. The Rails-to-Trails Conservancy also maintains a number of resources on its website (www.railstotrails.org).

A trail within/parallel to the Burlington Northern-Santa Fe Railroad corridor in the Bend area could provide a substantial enhancement of the Primary Trail system. The *Bend Urban Area - Bicycle and Pedestrian System Plan* illustrates the alignment of this “Rails-with-Trails” concept. It should be acknowledged that, due to site specific railroad operational requirements, alternative parallel accessway/roadway corridors may be more suitable for avoiding problematic sections of this rail-trail corridor. Also, grade-separated rail-roadway crossings may be difficult to retrofit or may be operationally unsuitable for joint trail and rail operation and parallel alternative routes should be considered. Typically, these alternative routes, if used, should not deviate physically too far from the intended corridor alignment (i.e., follow the nearest parallel alternative corridor). Further planning and discussion with the railroad representatives, adjacent property owners and field investigations are required to determine the feasibility of this concept.

Unpaved Paths

In general, the standard width of an unpaved path is the same as for sidewalks. An unpaved path should not be constructed where a sidewalk is more appropriate. The surface material must comply with the ADA.

Ongoing Plans and Programs

The following is a summary of pedestrian specific plans and programs that are ongoing in the Bend MPO area.

Strategic Implementation Plan for Walking and Biking Infrastructure

The City of Bend and Bend MPO are in the process of developing this plan. When completed, it will outline a strategy for incorporating bicycle and pedestrian focused projects into the City’s Capital Improvements Plan (CIP). To date, the effort has identified five “Pedestrian Zones” where walkable areas have the most potential. The zones were prioritized against each other and specific projects identified for the top three zones. The City has received project ideas from the public related to upgrading/completing existing facilities, improving crossings of multi-lane roads, and creating new connections within these zones. The plan is also identifying important corridors where accessibility improvements are needed.

ADA Transition Plan for Curb Ramps in Public Rights-of-Way

Completed in February 2014, this plan outlines how the City will improve curb ramps to meet accessibility standards.

ADA Improvement Construction Program

The City of Bend maintains an ongoing program to upgrade curb ramps and construct sidewalks to improve accessibility. This program is currently focused on areas serving medical and government facilities. It is guided by the nine-member City of Bend Accessibility Advisory Committee.

Bicycle and Pedestrian Documentation Project

In 2013, the Bend MPO and the City of Bend began an annual bicycle and pedestrian counting program. This program is modeled after the National Bicycle and Pedestrian Documentation Project. The program involves volunteers counting two-hour periods at about 30 designated locations on a quarterly basis on both weekdays and Saturdays.

Road User Safety Task Force

Initially formed to improve road safety for people on bicycles, the road user safety task force now focuses on reducing crashes between motor vehicles and bicycles and pedestrians. Many of the task force's efforts are aimed at educating road users. Notable projects the group has taken on include media campaigns, obtaining a proclamation from the Bend City Council of a road safety week in each year starting in 2010, and the previously described bicycle and pedestrian documentation project.

Deschutes County Bicycle and Pedestrian Advisory Committee

A group of local residents makes up the Deschutes County Bicycle and Pedestrian Advisory Committee. Its members are appointed by the Deschutes County Board of Commissioners, but the committee also serves the City of Bend and ODOT. The committee is involved in a number of promotional and educational activities and serves as an advisory group to specific projects. It maintains its own website that it uses to disseminate information about upcoming projects and general bicycling and walking educational materials.

Pedestrian Injury Prevention Action Team Program

Commute Options was recently selected to participate in the *Pedestrian Injury Prevention Action Team Program* run by the Safe States Alliance. As a part of this program, Commute Options staff will receive guidance in preparing training materials for local and State agencies and conduct these trainings and have the access to grant funds that can be awarded to local agencies.

The Bicycle System

Residents and tourists of all ages enjoy bicycling for both transportation and recreation. Bend's relatively small size and short distances encourage travel by bicycle. The MPO area has been designated as a silver-level Bicycle Friendly Community by the League of American Bicyclists. In awarding this designation to the City and the adjacent urbanized area of Deschutes County, the League noted strong points of the community's application as being the culture of the region, promotional and educational efforts (e.g. Bike Month, Bicycle Diversion Program), Commute Options' services, and improvements being made to the on and off-street networks.

Existing and Proposed Bicycle System

The majority of the current bike system is found on arterial and collector streets as bike lanes. The network of multi-use trails also serves as an important part of the bike system. Based on need and road characteristics, all roads open for public use should be considered for the potential to improve travel opportunities by bicycle. Facilities should safely accommodate users.

The existing and proposed bicycle system is delineated in Figure 7-2. These facilities are based on an inventory from the *Bend Urban Area TSP* and also reflect projects that have been completed after the TSP. The system as proposed should be considered general in nature. Flexibility should be permitted during the development and design of roadways and private lands to locate these planned bicycle facilities to fit the context of the natural terrain, to minimize grade, to minimize safety issues, and consider any other topographic or geographic barriers or issues. It is the intent of the bicycle system to provide direct and convenient bicycling connections to parks, schools, open spaces, employment areas, shopping destinations, and the like.

The City's *Strategic Implementation Plan for Walking and Biking Infrastructure* described above includes the development of priority bicycle improvement projects for the City. Phase II of the MTP Update will incorporate these projects into the 2040 MTP. Chapter 6 of this MTP identifies the committed and build projects for the City. Although some of the identified projects are new roadways or roadway upgrades, which will include a bicycle facility component, the majority of bicycle facility projects will be covered under the funding allocated for the City of Bend local transportation projects.

During the city's Strategic Implementation Planning efforts, there was a strong desire to enhance bike system elements above and beyond the basic provision of a bike lane. The following section identifies bike system components that will help the city fulfill that desire.

Components of the Bicycle System

The following is a description of the components of the existing and planned bicycle networks. More detailed information on these and other bicycle facilities can be found in the City of Bend's 2014 publication *A Complete and Attractive System of Bikeways Tool Box*.

Bike Lanes

A bike lane is a space on the road shoulder that is delineated from the adjacent vehicle travel lane by a solid white striped line. Bike lanes are provided on both sides of the street and promote travel in the same direction as the adjacent lane of traffic. This practice provides an exclusive place for bicycles and requires a cyclist to conform to the laws of motor vehicle travel.

Bike lanes are intended to provide a convenient and exclusive location for bicycles on collectors and arterials. Bike lanes provide a clear and distinctive location on the road for bikes to travel at their own speed. They improve driver expectation of bike movements and they reduce bike and auto conflicts. Bike lanes provide a benefit to all modes of travel. For pedestrians, they help separate bike movements from the sidewalk and they increase walking comfort due to the increased sidewalk separation from adjacent auto traffic. For motor vehicle traffic, the lanes add buffer space from roadside obstacles and they improve driveway and intersection sight distances.

It is preferable not to permit on-street parking next to a bike lane due to the hazard of opening car doors and the conflict of cars moving in and out of the parking stalls. However, there may be locations where it is necessary to provide both parking and bike lanes. Where space is limited, one design solution is the construction of recessed parking bays to better accommodate the space requirements for both needs. Another solution is to provide a buffer space between the bike lane and the parking lane that moves cyclists out of the “door zone.” In other cases, such as the commercial downtown core area where a large inventory of on-street parking is essential, the need to provide vehicle parking may take priority over the delineation of bike lanes. In that case, where lower traffic speeds can be maintained, bikes can be accommodated through a mixed traffic flow such as with Shared Markings.

Buffered Bike Lanes

A buffered bike lane is similar to a conventional bike lane, but it is separated from the adjacent motor vehicle travel lane and/or parking lane by a painted buffer. The painted buffer space increases comfort by providing further separation between bicycle and motor vehicle traffic (or the doors and mirrors of parked cars).

Protected Bike Lanes/Cycle Tracks

Protected bike lanes, also called cycle tracks or separated bike lanes, separate bicycle traffic from motor vehicle traffic using a physical barrier. Common barrier types include plastic bollards, parked cars, and curbing (including a raised bike lane). The physical barrier further increases comfort for bicyclists. It also introduces additional considerations that need to be accounted for depending on the barrier type (e.g. maintenance). There are two examples of protected bike lanes within the Bend MPO Area. In 2003 the city constructed a raised bike lane on Reed Market Road as part of the Southern River Crossing project. A recently completed project on Riverside Boulevard provides a nice example of a protected bike lane application within the Bend MPO area.

Rural Bikeways

On most rural roadways, shoulder bikeways are appropriate, accommodating cyclists with few conflicts with motor vehicles. In general, the minimum shoulder widths recommended by ODOT's Bicycle and Pedestrian Design Guide for rural highways are adequate for bicycle travel. These standards take into account traffic volumes and other considerations. Shared roadways are adequate on low-volume rural roads, where motor vehicle drivers can pass bicyclists due to the low likelihood of encountering on-coming traffic. Shoulder bikeways can be added to roads with high bicycle use, such as in semi-rural residential areas or close to urban areas. It may be appropriate to stripe and mark shoulders as bike lanes near schools or other areas of high use. Even adding minimal-width shoulders can improve conditions for bicyclists on roads with moderate traffic volumes. On roads with high use, it may be necessary to add full-width shoulders in areas of poor visibility due to topography.

Shared Roadways

There are no specific bicycle standards for most shared roadways; they are simply the roads as constructed. Shared roadways function well on local streets and minor collectors, and on low-volume rural roads and highways. The majority of rural roads in the region are shared roadways. Shared roadways are suitable in urban areas on streets with low speeds (25 MPH or less) or low traffic volumes (3,000 ADT or less, depending on speed and land use). In rural areas, the suitability of a shared roadway decreases as traffic speeds and volumes increase, especially on roads with poor sight distance. The city is considering creating a network of shared urban roadways called Bikeways, which would provide a comfortable road to travel on away from the busier traffic of the arterial roadways. Arterial crossings would be an important design elements of the Bikeways.

Wide Curb Lanes

A wide curb lane may be provided where there is inadequate width to provide the required bike lanes or shoulder bikeways. This may occur on retrofit projects where there are severe physical constraints, and all other options have been pursued, such as removing parking or narrowing travel lanes. Wide curb lanes are not particularly attractive to most people on bikes; they simply allow a motor vehicle to pass the slower vehicle within a travel lane.

To be effective, a wide lane must be at least 14 feet wide, but less than 16 feet. Usable width is normally measured from curb face to the center of the lane stripe, but adjustments need to be made for drainage grates, parking and the ridge between the pavement and gutter. Widths greater than 16 feet encourage the undesirable operation of two motor vehicles in one lane. In this situation, a bike lane or shoulder bikeway should be striped.

Shoulder Bikeways

Paved shoulders are provided on rural highways for a variety of safety, operational and maintenance reasons:

- Space is provided for motorists to stop out of traffic in case of mechanical difficulty, a flat tire, or other emergency;
- Space is provided to escape potential crashes;
- Sight distance is improved in cut sections;
- Highway capacity is improved;
- Space is provided for maintenance operations, such as snow removal and storage;
- Lateral clearance is provided for signs and guardrail;
- Storm water can be discharged farther from the travel lanes; and
- Structural support is given to the pavement.

Bike Parking Facilities

For a bikeway network to be used to its full potential, secure bicycle parking should be provided at likely destination points. Lack of secure parking is often cited as a reason people hesitate to ride a bicycle to certain destinations. Bicycle parking should also be convenient, easy to access, and provide suitable protection from the weather. Bike parking needs to be designed for both short- and long-term use, depending on site conditions and demands. The city of Bend has provided a number of short-term bike racks throughout the central business area. These racks have helped reduce some of the automobile parking demand in this activity center. To support public transportation service, bike-parking facilities should be provided at all park and ride lots, major transit stops and transit center facilities. Adequate bike parking facilities need to be provided where other public facilities, such as libraries, parks, recreation centers and schools, are constructed and wherever automobile traffic is provided.

Ongoing Plans and Programs

The following is a summary of bicycle-specific plans and programs that are ongoing in the Bend MPO area.

Strategic Implementation Plan for Walking and Biking Infrastructure

The City of Bend and Bend MPO are in the process of developing this plan. When completed, it will outline a strategy for incorporating bicycle and pedestrian focused projects into the City's Capital Improvements Plan (CIP). To date, in regards to bicycle infrastructure, the effort has identified guiding principles, project delivery strategies, a phasing approach, and a series of priority corridors and critical gap closure projects.

Bicycle Diversion Program

The mission of the bicycle diversion program is "education through enforcement." Under this program, people who are cited for bicycle-related traffic infractions are given the option to have their fine reduced by taking an educational course that is offered monthly. The program is a collaborative effort of local enforcement agencies, the City of Bend, and Commute Options.

Bicycle and Pedestrian Documentation Project

Road User Safety Task Force

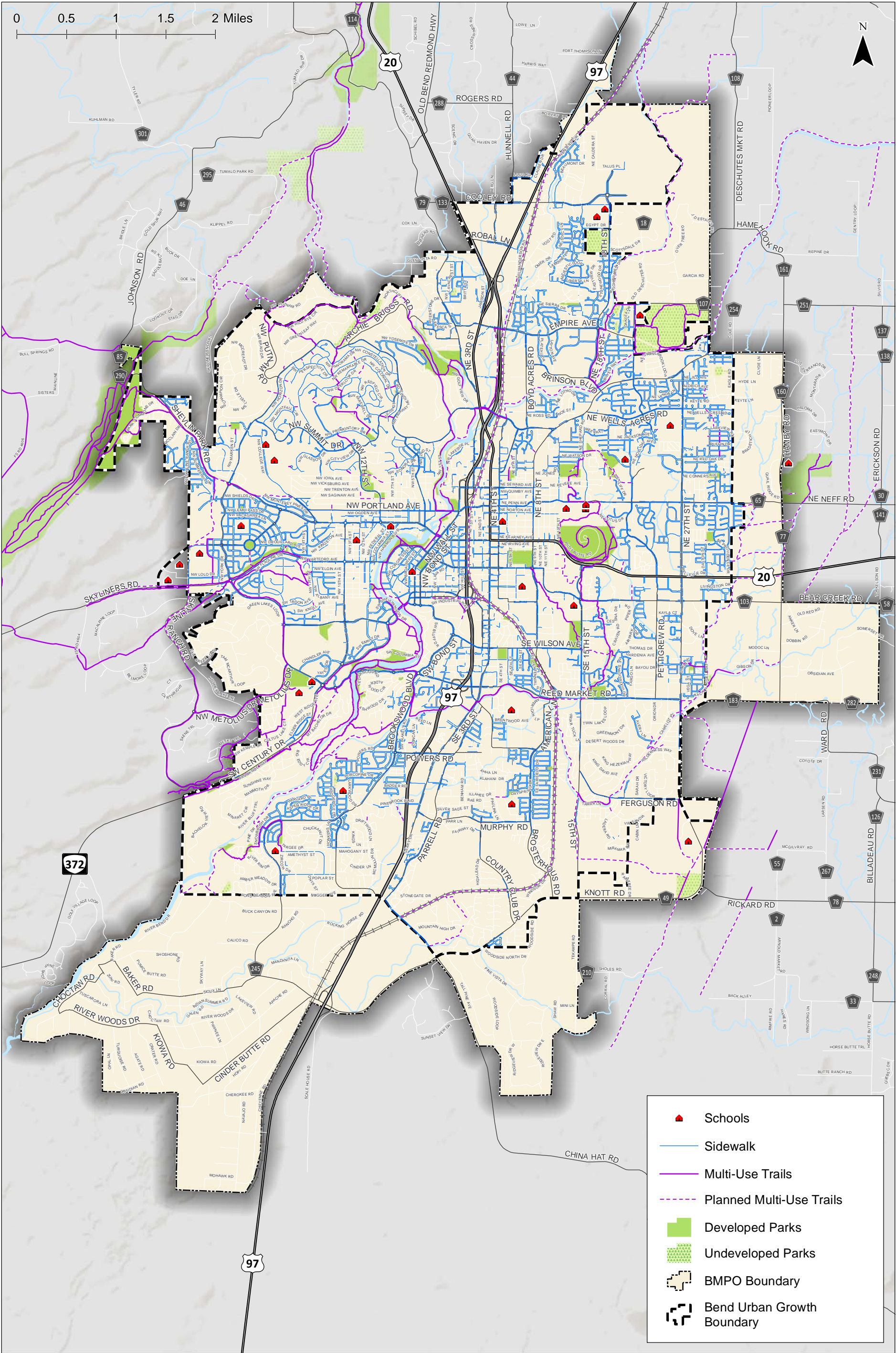
Deschutes County Bicycle and Pedestrian Advisory Committee

See the Pedestrian section for descriptions of this project and these groups.

Bicycle and Pedestrian Policies

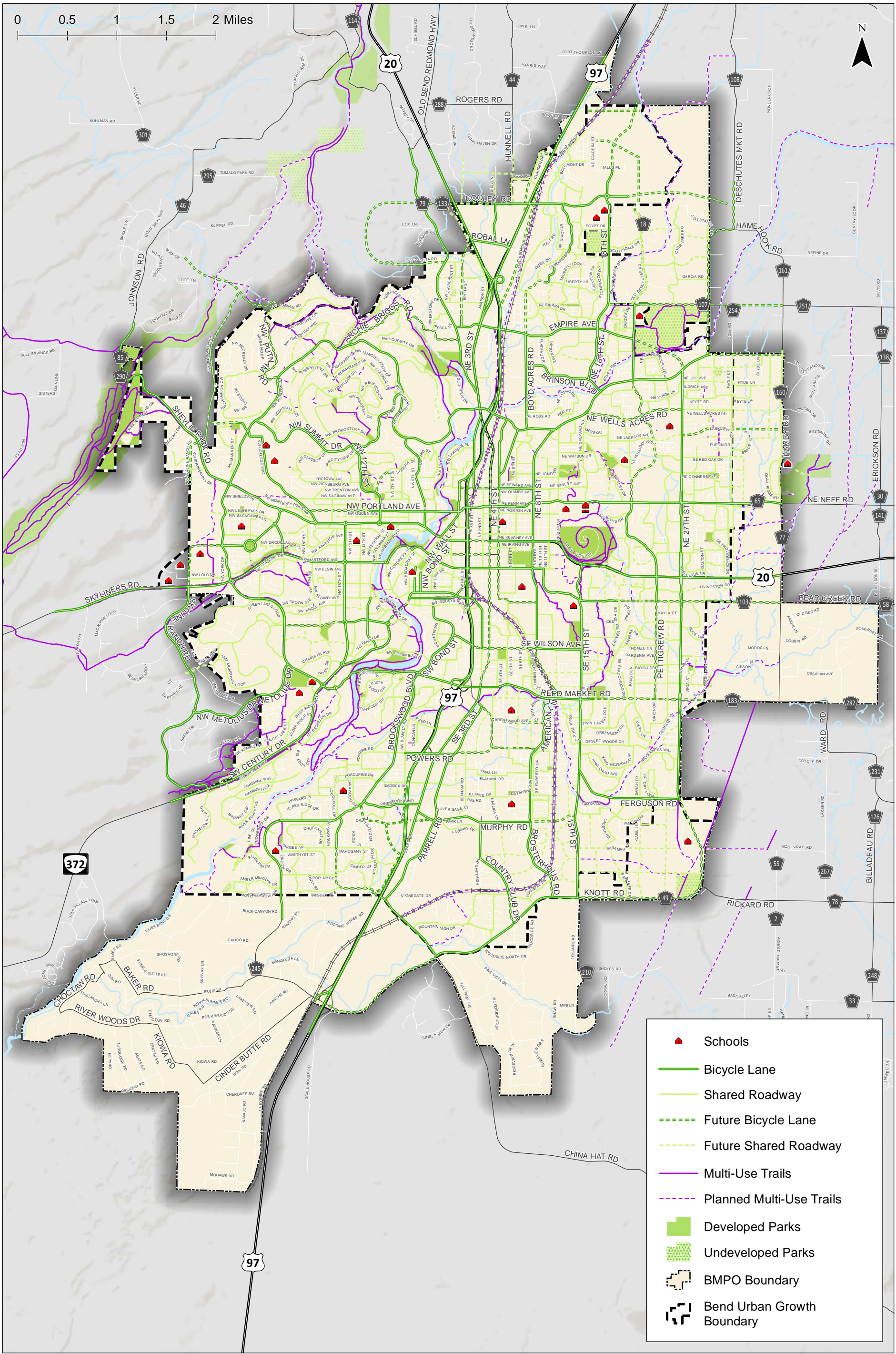
1. Assist the City, County, State, Forest Service, Park District and other agencies, including irrigation districts, to acquire, develop and maintain a series of trails along the Deschutes River, Tumalo Creek, and the irrigation district canal system so that these features can be retained as a community asset. Work with these same agencies to identify and develop connections between the Bend Urban Area Bicycle and Trails System and the USFS trail system.
2. Assist the City and Park District to acquire, develop and maintain the primary trails designated on Figure 7-2.
3. Assist the City with developing safe and convenient bicycle and pedestrian circulation to major activity centers, including the downtown, schools, shopping areas, and parks. Particular emphasis should be given to east-west access barriers to the downtown area (e.g. the Bend Parkway, the railroad, etc.).
4. Work with the City to facilitate easy and safe bicycle and pedestrian crossings of major collector and arterial streets. Work with the City to identify intersection designs that include pedestrian refuges or islands, curb extensions and other elements where needed for pedestrian safety and extend bike lanes to meet intersection crosswalks.
5. Work with the city and county to ensure that bike lanes or bikeways are included on all new and reconstructed arterials and collectors. Add bike lanes to existing arterial and collector streets with particular emphasis to fill the gaps in the on-street bikeway system. Provide an appropriate means of pedestrian and bicyclist signal actuation at all new or upgraded traffic signal installations.
6. Work with the city to ensure that property-tight sidewalks are included on both sides of all new or reconstructed arterial and collector streets except where extreme slopes, severe topographical constraints, or special circumstances exist. Add sidewalks to all existing arterial and collector streets to fill the gaps in the pedestrian system.
7. Work with the City and County to develop a program to ensure timely maintenance and repair of all sidewalks, including, but not limited, to assigning responsibility for maintenance and repair.
8. Work with the City and County to ensure that bicycle and pedestrian facilities are maintained in a manner that promotes use and safety. Perform street repair and maintenance in a manner that does not negatively impact bicycle and pedestrian facilities and their use.

9. Work with the City to ensure that bicycle parking facilities are provided at all new multifamily residential, commercial, industrial, recreational, and institutional facilities, major transit stops, transit stations, and park-and-ride lots.
10. Encourage the City to establish or maintain accessways, paths, or trails prior to vacating any public easement or right-of-way.
11. Work with the City, County, and State to support bicycle and pedestrian education and safety programs.
12. Work with the City and the Burlington Northern – Santa Fe (BNSF) Railroad to determine where, if possible, railroad right-of-ways could be used also as trail corridors. Provided a joint-use agreement can be reached with BNSF, work with the City to evaluate the entire Rails with Trails Corridor in light of opportunities to augment the local primary trail system.
13. Work with the City, County, and Park and Recreation District, to identify funding options for right-of-way acquisition, design, construction and maintenance of priority trails.
14. Work with the City, County, and Park and Recreation District to update sidewalk, trail and bike lane systems inventories and identify gaps and missing system segments and prioritize these for completion.
15. Work with the City to identify specific annual targets for sidewalk in-fill projects.
16. Work with the City and County to identify specific annual targets for bikeway in-fill projects.
17. Work with the City and Park and Recreation District to identify specific annual targets for securing public right-of-ways or easements for trails and constructing trails.



**Pedestrian Facilities
Bend, Oregon**

**Figure
7-1**



- Schools
- Bicycle Lane
- Shared Roadway
- Future Bicycle Lane
- Future Shared Roadway
- Multi-Use Trails
- Planned Multi-Use Trails
- Developed Parks
- Undeveloped Parks
- BMPO Boundary
- Bend Urban Growth Boundary

**Bicycle Facilities
Bend, Oregon**

**Figure
7-2**



Chapter 8: Public Transportation System

Introduction

The Bend area has experienced rapid population growth in the last decade, reaching approximately 90,000 residents, and that growth is expected to continue to approximately 140,000 residents by 2040. The area's rapid housing and employment development brings with it an increasing need for expanded public transportation services. The Bend Metropolitan Planning Organization (BMPO) and City have developed various public transportation plans that can be used to provide guidance on how to accommodate on-going growth within the area fixed route system.

Public transportation is an important element of multi-modal transportation planning and provides mobility options for the traveling public. Providing transportation options is important for all people and it is essential for those who are unable to drive motor vehicles. There are many segments of the population that are unable to drive or do not have a vehicle available. People may not be able to drive due to age or health. School age children, especially youths aged 10-17, seniors (aged 65 or above), and persons with disability may not be able to legally and safely operate motor vehicles. Other people may not own cars for financial reasons or individual preference. Many low-income households do not own private motor vehicles. Public transit allows this wide range of people the opportunity to travel for a variety of purposes.

Public transportation also provides a valuable alternative to travel by single-occupancy vehicle and potentially reduces motor vehicle demand on roadways. Public transportation can improve the efficiency of highways and arterial streets. It can reduce the need for costly capacity expansion projects, as fewer vehicles are required on the road to serve the same number of people. It can improve congestion by providing for people who would otherwise be putting additional vehicles on area roadways. Improvements to air quality can also be achieved by the net reduction of motor vehicle emissions. Public transportation can also play an important role in reducing congestion and parking requirements in high demand areas such as the downtown, opening up development opportunities for the community.

Planning Context

Three recent studies have identified issues and strategies toward improving transit services in Central Oregon:

- BMPO Public Transit Plan and Corridor Land Use Assessment (PTP)¹
- Central Oregon Regional Transit Master Plan (RTMP)²

¹ Public Transit Plan and Transit Corridor Land Use Assessment, Bend Metropolitan Planning Organization, March 2013

² Central Oregon Regional Transit Master Plan, Central Oregon Intergovernmental Council, June 2013

- Central Oregon Strategic Transportation Options Plan (COTOP)³

The PTP serves as the Public Transit Plan for the Bend Metropolitan Planning Organization (BMPO) and will be adopted as a component of the BMPO Metropolitan Transportation Plan (MTP) Update. The PTP will also be adopted as a component of the City of Bend Transportation System Plan (TSP) and will be a companion to the City of Bend Comprehensive Plan, for land use planning actions and decisions.

The RTMP identifies where future transit services can support regional transportation and sustainability goals. The Plan provides a 20-year vision for the Central Oregon Intergovernmental Council (COIC), identifying needed improvements and funding strategies to effectively provide transit services for the region.

The COTOP was developed for the COIC to analyze transportation options for inter-city travel programs that include transit and carpool/vanpool services, bus and commuter rail. The Plan identifies cost-effective investments to support long-term inter-community travel demand in Central Oregon.

The following sections summarize the key policies, findings and identified improvement strategies from each of these three studies. The PTP is emphasized, as it is the Plan specifically applicable to the BMPO. The relevant elements of other regional studies are also identified.

Policies

The goals and objectives for the public transportation system were identified in the PTP. The goals and objectives were built upon the existing BMPO MTP strategies and Bend TSP objectives, policies, and actions. The four goals identified in the PTP are:

- Goal 1: Provide public transportation services for the transportation disadvantaged
- Goal 2: Reduce reliance on automobiles and develop public transportation facilities
- Goal 3: Increase mobility, accessibility, and visibility of transit throughout the urban area
- Goal 4: Provide infrastructure and land use planning to support transit

Objectives are defined to guide and support implementation of strategies that achieve progress towards the goals of the PTP.

- Objectives 1.A: Preserve and improve the existing Dial-A-Ride service.
- Objective 1.B: Equitably provide transit services throughout the city, including to areas with high concentrations of low-income households, households without a vehicle, seniors, and people with disabilities.

³ Central Oregon Strategic Transportation Options Plan, Central Oregon Intergovernmental Council, July 2013

- Objective 1.C: Provide transit service to all middle and high schools, as well as higher education facilities.
- Objective 2.A: Support and promote expansion of a reliable public transportation system that makes transit an attractive travel choice for Bend residents and visitors in order to reduce reliance on the automobile. Over time, the best transit service in Bend (highest frequency, most reliable, longest service span, etc.) should be provided in “primary transit corridors,” as presented in the Public Transit Plan.
- Objective 2.B: Work with other governmental agencies to support implementation of a 20-year Public Transit Plan. Ordinances shall be adopted that implement the Public Transit Plan.
- Objective 3.A: Work with COIC, Central Oregon communities, and the State to maintain or improve connections between local Bend transit services and inter-urban public transportation services. Priority shall be given to high-ridership corridors and connections.
- Objective 3.B: Coordinate with the Central Oregon Intergovernmental Council (COIC), the State, and other jurisdictions to evaluate funding alternatives and seek appropriate resources to preserve and support future expansion of the public transportation system. Effort should be made to evaluate creative funding techniques that may include the combination of public and private transportation resources in coordination with other agencies and transportation providers.
- Objective 3.C: Continue to partner with local organizations, businesses and agencies to enhance the image of transit throughout the community.
- Objective 4.A: Implement land use ordinances and other regulations that establish pedestrian and transit-friendly design along potential or existing transit routes, to improve access to the fixed-route transit system.
- Objective 4.B: Encourage new development requiring transit service, such as schools, hospitals, clinics, high-density housing, etc., to locate along an existing transit route. Encourage the highest-intensity uses to locate along primary transit corridors, which would offer the highest level of transit service.
- Objective 4.C: Support implementation and/or improvement of secondary transit hubs including the Central Oregon Community College, the St. Charles Medical Center, and sites on the north and south reaches of Bend, including land acquisition and other infrastructure.
- Objective 4.D: Acquire properties (or secure joint use agreements) for Park-n-Ride lots at strategically located sites throughout the urban area. These locations may be co-located with secondary transit hubs or other major stops (see also Objective 4.C).

Existing Transit Services

The primary transit service provider for the Bend MPO is Cascades East Transit (CET). CET provides local (City) fixed-route service, regional (intercity) fixed-route service, and flexible demand-responsive service. The CET services are supplemented by other intercity transit providers. The following sections provide an overview of CET and other providers in the Bend MPO area.

Cascade East Transit

The CET local transit service includes seven routes within Bend. The routes are designed to radiate from Hawthorne Station, the main transit center in the Bend transit system, in a system design referred to as “hub-and-spoke”. Hawthorne Station is located between 3rd Street and 4th Street on Hawthorne Avenue. The fixed route transit services are illustrated in Figure 1. Most of the routes provide drop-off and pick-up every 40 minutes on weekdays from between 6:20 a.m. and 6:15 p.m. and every 80 minutes from approximately 8:00 a.m. to 5:00 p.m. on Saturdays. Full price fare within Bend is currently \$1.50 for one-way travel, with day passes available for \$2.50.

CET also operates the Community Connector service which provides direct regional connections between Bend and La Pine and Redmond. From Redmond, additional connections are available to Prineville, Madras, Sisters, and the Redmond Airport. From Madras, connections to Metolius and Culver are also available. The fixed route intercity transit services are illustrated in Figure 2. Regional service routes generally operate on Weekdays during a.m. and p.m. peak commute hours. Seasonal service to Mt. Bachelor (winter) and the Ride the River route (summer) in Bend are also provided.

CET’s demand-responsive service is Bend Dial-A-Ride, providing shared-ride service to people with disabilities and low-income seniors who do not live near fixed-route service. One-way fares are \$2.50, with half price discounts available to low-income riders.

Key service characteristics for CET are summarized in Table 1. Funding for the transit system comes primarily from federal assistance and local sources. The City of Bend provides approximately \$1 million annually from its general fund to meet local matching requirements for federal funding. Fare collection generally covers about 10 percent of operating expenses⁴.

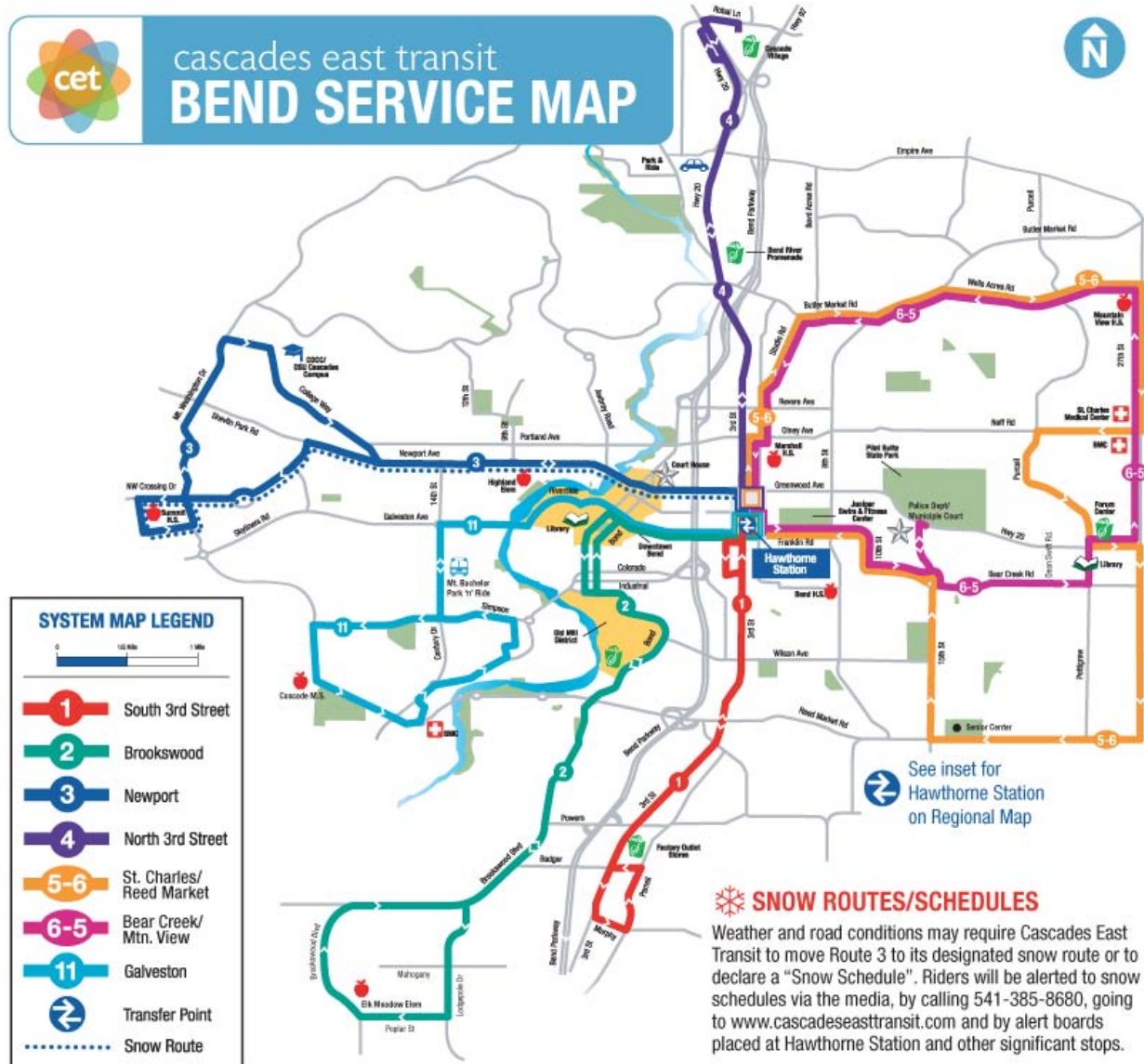
⁴ National Transit Database,
http://www.ntdprogram.gov/ntdprogram/pubs/profiles/2010/agency_profiles/0050.pdf

Table 1. Bend Area Transit Service Characteristics – 2010

Annual Passenger Trips	175,000
Average Weekday Trips (Unlinked)	1,400
Fare Revenues	\$250,000
Operating Expenditures	\$2,500,000
Capital Expenditures	\$450,000
Buses – Total (Fixed Route/Demand Response)	23 (10/13)

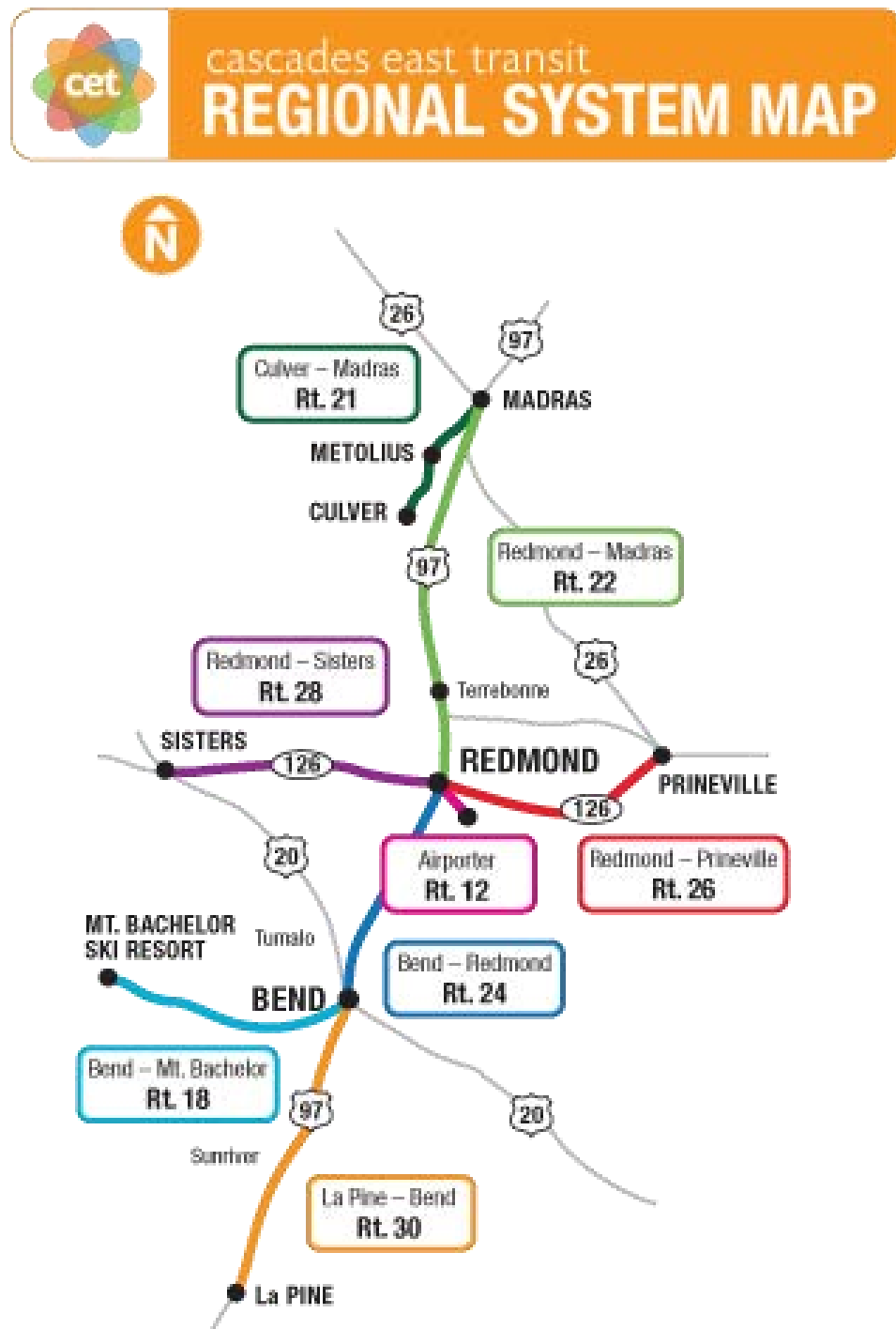
Source: 2010 National Transit Database

Figure 1. CET Local Fixed-Route Service



Source: Cascade East Transit, <http://www.cascadeseasttransit.com/routes-schedules/where-are-you-going.html>

Figure 2. CET Regional (Intercity) Fixed-Route Service



Source: Cascade East Transit, <http://www.cascadeseasttransit.com/routes-schedules/city-service/city-service.html>

Other Intercity Bus Services

The following bus services provide intercity travel options in the Bend MPO area:

- *Central Oregon Breeze*, operated by CAC transportation, provides daily bus service between Central Oregon and the Portland area. Central Oregon stops include the Sugarloaf Mountain Hotel in Bend, Redmond Airport and Madras. Portland Area stops include Union Station, Portland International Airport (PDX), and the Cleveland MAX stop in Gresham.
- *Amtrak* provides daily shuttle bus service called High Desert Point (between Chemult and Redmond), Eastern Point (between Ontario and Bend) and Eugene to Bend (between Eugene and Bend). These bus services provide connections to Amtrak's national passenger rail network.
- *Valley Retriever* provides shuttle service between Bend and Newport, Corvallis, Albany, and Salem.
- *Redmond Airport Shuttle* offers charter van and mini-van shuttle service between Central Oregon and Portland, Salem, Eugene, and Corvallis.
- *The People Mover* provides shuttle bus services three days per week between Prairie City (Grant County) and Bend.
- *Greyhound* provides intercity bus service connecting to a nationwide network of routes.

Travel Demand Management Programs

Transportation Demand Management (TDM) or transportation options (TO) are general terms for strategies that reduce reliance on single-occupancy motor vehicle trips. Commute Options for Central Oregon is the region's primary TDM program. Commute Options is a non-profit agency that serves as an advocacy group that supports a variety of TDM strategies and programs. It facilitates vanpools, carpools, park and ride lot development, bike corrals, pedestrian facilities and marketing for transit. It also administers the Drive Less Connect and commute options partner and rewards programs and delivers the educational components of the Safe Routes to Schools program.

- **Drive Less Connect** is an online rideshare and TDM tracking program in Oregon, Idaho, and Washington. It provides a tool to aid in organizing carpools and identifying other bike riders. It provides estimated cost savings that result for traveling by a mode other than single-occupancy motor vehicles.
- **Commute Options Partners** is a program that organizes employers to participate in TDM activities. Transportation Coordinators are designated at the member business or organization to facilitate employee participation in Drive Less Connect.
- **Commute Options Reward Program** offers reward to employees of organization that are registered in the Commute Options Partners program.

Identified Needs

Needs for CET transit service were identified in the PTP and the RTMP, while intercity transit service was addressed in the COTOP. The needs identified for each are summarized below.

CET Transit Service

The RTMP highlights general needs for supplying transit services in the region:

- Maintain regional transit service (provided by CET) to take advantage of the benefits of an integrated, coordinated, and unified transit system.
- Identify a reliable, sustainable funding source for CET services
- Focus on service improvements to attract “choice” riders that have other transportation options.
- Support higher density land use development to create activity centers that support transit services.
- Improve and maintain primary transit facilities and access for bikes and pedestrians.
- Maintain or improve the condition of the vehicle fleet and other equipment and capital investments.
- Improve awareness of the CET transit services

Major needs for CET transit services were identified and prioritized as part of the PTP. The highest priority needs related to expanding the service frequency and operating hours of existing services. The lowest priority needs were expanding the service coverage area and providing faster or more direct service. The prioritized needs for CET services are summarized in Table 2.

Table 2. Prioritized Transit Needs

Expressed Major Service Needs	Overall Priority
Early Evening Service Hours (6:00 – 8:00 p.m.)	High
Increase Saturday Frequency	High
Provide Sunday Service	High
Increase Weekday Frequency	High
Later Evening Service Hours (8:00 – 10:00 p.m.)	Medium
Expand Saturday Hours	Medium
Early Morning Service Hours (Start at 5:00 a.m.)	Medium
Provide Faster, More Direct Service	Low-Medium
Expand Service Coverage	Low-Medium

Source: Bend MPO Public Transit Plan, Figure 5-1

Specific issues highlighted include difficulty with on-time performance on Route 5 (Wells Acres) leading to late arrivals and overcrowding, limited service hours on Route 11 (Galveston), and the general difficulty of travel planning with 40-minute headways on most routes. The desire to expanding service coverage within Bend and improving

regional connections were also identified. Additional details of the existing conditions needs assessment and key findings are available in Chapter 5 of the PTP.

Intercity Transit

The COTOP analyzed intercity transportation in Central Oregon, focusing on the corridors that connect Bend, Redmond, Sisters, Prineville, Madras, La Pine, and Culver/Metolius. The COTOP analyzed a variety of strategies to provide intercity travel options including commuter rail, vehicle-mile-traveled (VMT) pricing, transit enhancements and vanpool enhancements. The costs and benefits were evaluated for providing these alternative strategies on each of the key corridors that connect these communities.

The overall conclusion of the COTOP is that, although transit investments are difficult to justify on the basis of reducing capacity constraints on intercity corridors, providing lower cost mobility options has significant user and societal benefits.

Key findings of the study are summarized below:

- There is relatively **little congestion** through 2030 on the highway corridors that provide the majority of intercity connections in Central Oregon.
- Shifting intercommunity trips has relatively **little impact on congestion** on the intercity highway corridors, as the majority of trips have origins and/or destinations outside of the Central Oregon communities analyzed.
- **Reducing VMT is the most significant benefit** of providing improved intercity transit services, as a result of shifting demand away from single-occupancy vehicle travel on longer-distance trips.
- Transit **investments on the Redmond-Bend corridor are the most cost-effective** due to demand between the communities. A market assessment found the Redmond-Bend corridor to have the highest potential for transit investments in the region. Bend-Sisters and Bend-La Pine were considered to have moderate market potential, based on the criteria of the report
- Transit **investments are not warranted between some of the smaller communities**, based on low demand for travel between them, even through 2030.
- Community Connector **fares are not competitive on shorter-distance intercity trips** such as those between Culver and Metolius (when compared to driving).
- Although it would produce benefits where implemented, a number of **significant challenges exist for Commuter Rail** service. These challenges include high capital and operating costs, freight-owned right-of-way, limited coverage with the region (i.e., the US 97 corridor), and poor alignment with supportive land uses on the proposed alignment.
- **Pricing strategies (e.g., VMT-based driving fee) could be effective** as a complement to intercity transit investments. However, high quality alternatives must be in place to result in significant vehicle trip reductions.
- **Local transit services and connections are critical** for intercommunity transit effectiveness. The quality of local transit service, how accessible the transit stops are for people who walk and bike, and the degree to which land use strategies

support transit and may significantly affect ridership potential of intercity transit services.

- Intercity vanpool and transit investments **have the ability to impact local traffic operations** within communities, particularly at so-called “first intersections” near the end points of intercity transit services.

Land Use Organization

Developing supportive land uses is an important strategy for effective transit systems. Land uses that include high-density residential, mixed-use, entertainment and employment concentrations support transit route ridership. Bend’s Comprehensive Plan designates the types of land uses; high-density, mixed-use and commercial activities, along the arterial and collector street system that is likely to have transit service.

Site design elements such as building layouts that site structures in close proximity to the street and provides convenient pedestrian access also promote transit trip activity. The City of Bend Development Code incorporates the transit friendly site design objectives of the State Transportation Planning Rule (OAR 660-012).

The Complete Transit System is identified in the PTP as a unifying concept for complementary transit service quality and land use elements. The concept describes land use policies functioning together with non-service elements such as pedestrian and bicycle access and transit facilities. Coordinated development of these elements provides the foundation for improving transit service in Bend.

Planned Improvements

The PTP identifies a robust plan for the CET transit system including short-term, mid-term, and long-term improvements. Improvements are identified for service quality and non-service elements such as facilities, amenities, access, and marketing.

Service Quality

Short-term improvements are focused on addressing the most pressing operational issues without increasing operating costs. Mid-term and long-term improvements are built around developing primary transit corridors and restructuring the transit system into a more flexible and scalable model that will support continued growth. The cost of the initial restructuring in the mid-term is financially constrained, based on evaluation of peer systems. The long-term concept is not financially constrained, but maintains required funding levels within the range of peer systems.

The following summarizes the timeline and key developments for PTP’s proposed service concepts:

- **Short-term** (Years 1 to 3): Address the most pressing operational issues; including enabling Route 5 (Wells Acres) to run within a 40-minute schedule all day by restructuring it to interline with Route 6 (Bear Creek).
- **Near Mid-Term** (Year 4): Routing modifications for Route 3 (Newport to COCC) and Route 11 (Galveston), with additional service on Route 11 to support the

planned OSU facility on SW Century Drive. Also, one additional evening run should be provided on all routes, extending service until nearly 7:00 p.m. on weekdays. Stop infrastructure would be required for the proposed route redesigns.

- **Mid-Term** (Years 5 to 10): An initial implementation of the restructured system, providing more frequent service (every 30 minutes) for several routes on primary transit corridors. Other routes with less demand would run hourly. Users could make transfers more easily and the system would be more flexible and scalable over time. Several routes would be modified and a new route (Greenwood to Forum Shopping Center and St. Charles Medical Center) would be added. Transit service hours would be expanded to early evenings on weekdays (until 8 p.m.) Two additional vehicles would be required along with stop infrastructure related to route redesign.
- **Long-Term** (up to 20 years). A set of flexible service options can be implemented in phases, linked to available funding and criteria for service expansion. The concepts include expanding service hours on weekdays and Saturdays, implementing Sunday services, and expanding service in NE and SE Bend, if warranted by development characteristics in those areas. Significant operating and capital improvement funds would be needed for the proposed increases in frequency and additional routes.

The service characteristics over time are summarized in Table 3.

Table 3. Recommended Service Characteristics

Time Frame	Short-term Years 1-3	Near Mid-Term Year 4	Mid-Term 5-10 Years	Long Term up to 20 Years
Weekday Service Hours	6:15 AM – 6:15 PM Route 11 runs only 6 hours per day	6:15 AM – 7:00 PM (one additional trip) Route 11 runs all day	6:00 AM – 8:00 PM	5:00 AM – 10:00 PM 60 minute service after 8:00 PM
Weekday Headways	40 minutes	40 minutes 60 min. on Route 11	30 or 60 minutes	15, 30 or 60 minutes (variable by route and time of day)
Saturday Service Hours	7:00/8:00 AM – 4:00/ 5:00 PM No Route 11 service	No Change Saturday Service on Route 11	8:00 AM – 5:00 PM	7:00 AM – 7:00 PM
Saturday Headways	80 minutes	No Change	60 minutes 1	30-60 minutes

Sunday Service Hours	None	None	None	8:00 AM – 5:00 PM
Sunday Headways	N/A	N/A	N/A	60 minutes
# of Routes	7	7	8	9
# of Peak Buses	7	7	9	20
Estimated Capital Cost	\$12,000	\$68,000	\$656,000	\$2,766,000

Source: Bend MPO Public Transit Plan, Figures 7-13 and 9-3

Service design guidelines and performance standards are also suggested in the PTP, to aid in the effective management and timely implementation of improvements to the transit system. The system-level performance standards are related to efficiency, service quality and reliability. The route-specific performance standards include passenger per revenue hour, passengers per revenue mile, on-time performance, and passenger loading measures. The PTP recommends more periodic reporting on boardings and adding system and route-level measures to the Monthly CET Management Report. Additional details of the recommended service improvements and performance standards are available in Chapter 8 of the PTP and the associated cost estimates are identified in Chapter 9.

Non-Service Elements

Enhanced transit services are supported by non-service elements that better meet the needs of the public. The PTP describes a set of recommendations to non-service elements of the transportation system:

- **Stop Amenities:** may include route/time information, seating, shelters and trash receptacles.
- **Major Transit Stops:** are high demand transit stops where enhanced stop amenities such as real-time bus arrival information and bicycle parking should be provided. The major transit stops may function as secondary transit hubs where convenient transfers occur. Recommended major transit stops are identified in the east (at St. Charles Medical Center) and west (COCC). Other major transit stops may be supported in the north (Cascade Village), and south (location TBD) as development occurs.
- **Park & Ride Connections:** are parking facilities with convenient connections to transit. There are several locations proposed, primarily to serve longer-distance trips within the BMPO.
- **Pedestrian & Bicycle Access Improvements:** create safe, comfortable, direct pedestrian and bicycle facilities that connect to transit stops. Sidewalks should be well-lit and barrier-free. Intersections should have curb ramps for people with mobility impairments. Crossing opportunities should be nearby and comfortable for all users. Low-stress and high visibility bicycle facilities can significantly extend the range of transit users. Specific locations where these improvements should be considered include Greenwood Avenue, 3rd Street and Hawthorne Station.

- **Transportation Demand Management:** is a general term for strategies that reduce reliance on single-occupancy motor vehicle trips. Some of these strategies, such as subsidized transit passes, Guaranteed Ride Home programs, ride sharing and vanpool options can provide complementary options to increase the use of transit.
- **Transportation Management Associations:** are member-based organizations that support transit operations through a variety of community outreach efforts that make it easier for people to use transit. Examples include providing information on transit programs and services, coordinating with employers or large organizations, and facilitating ridesharing. Many of these functions are currently performed by CET and Commute Options.
- **Branding:** recommendations include fully transitioning from remnants of the defunct Bend Area Transit to the CET brand, to raise awareness of the services that are currently available.
- **Printed Marketing:** includes brochures, maps, and fliers. The recommended enhancements to existing materials including more Dial-A-Ride information, color-coded routes, and consistent naming conventions and descriptions.
- **Electronic Marketing:** includes online information at www.cascadeseasttransit.com. Possible improvements include links to other regional transportation providers and more information regarding planning and travel training. Establishing a social media presence via companies such as Facebook and Twitter may also be pursued to enhance awareness and online accessibility.

Additional details of the recommended non-service element enhancements are available in Chapter 8 of the PTP.

Implementation Actions

Implementation Actions were identified to phase in the recommendations of the PTP. Each action is associated with one of the four goals of the PTP. The PTP identifies a detailed phasing timeframe for each action; near short-term (first year), short-term (1-3 years), mid-term (4-10 years) and long-term (ongoing/monitor). For the RTP, the implementation actions are divided into short-term (0-5 years) and long-term (5 years or more) timeframes. The implementation actions are listed in Table 4 (modified from Figure 9-7 of the PTP).

Specific implementation actions for intercity transit service were recommended in the COTOP. These recommendations are summarized below:

- Transit and vanpool investments should be considered as part of any potential capacity-increasing projects on the Bend-Redmond corridor, as improving transit options on the corridor has the potential to significantly reduce motor vehicle demand.
- Strategic investments in marketing and incentives to expand intercity vanpool services should be considered, as they appear to be underutilized in the region.

- The interaction between Community Connector and local CET services should be considered in future transit system investments.
- CET should consider moving service on the Sisters-Redmond corridor to Sisters-Bend, where there is more travel demand potential. (Also recommended in the RTMP)
- Investment should be increased in the Drive Less Connect Program to expand outreach for intercity travelers.
- Due to high costs relative to benefits, investments in commuter rail should not be met unless unexpected developments occur.
- Consider agency support of VMT-based pricing as an alternative to the gas tax, to make intercity travel more cost-effective compared to motor vehicle travel.

Table 4. PTP Implementation Actions

Action #	Recommended Actions	Lead Implementer(s)	Short-Term	Long-Term
1.1	Ensure that local funding for Bend Dial-A-Ride service is maintained beyond the City of Bend's current funding commitment (through September 2015).	BMPO ¹ , CET ¹ , City of Bend ¹	✓	✓
Goal 1: Develop public transportation services for the transportation disadvantaged				
1.2	Acquire low-floor buses as part of new/replacement vehicle purchases and prioritize on routes with high levels of wheelchair boardings and/or ridership.	CET ¹	✓	✓
1.3	Assess balance between fixed-route and Dial-A-Ride services on a periodic basis, based on available financial resources and as fixed-route service is enhanced in the future. This could include evaluation of the costs and cost-effectiveness of providing Dial-A-Ride service that exceeds ADA requirements in terms of: (1) geographic coverage beyond the required ¾ distance from fixed-route service (currently anywhere within city limits); (2) service at days and times when fixed-route service does not operate (e.g., on Sundays); (3) eligibility for low-income seniors.	CET ¹ , City of Bend ²	✓	✓
Goal 2: Reduce reliance on automobiles and develop public transportation facilities				
	Funding			
2.1	Identify a source(s) for local matching funds (as needed) to secure additional transit funding under MAP-21. This could include assessment of City of Bend's willingness to increase its funding commitment	CET ¹ , BMPO ² , City of Bend ²	✓	
2.2	Ensure that local funding for fixed-route transit is maintained beyond the City of Bend's funding commitment (through September 2015). Develop local funding sources sufficient to support the mid-term service improvements recommended in the PTP.	BMPO ¹ , CET ¹ , City of Bend ¹	✓	✓
2.3	Renegotiate terms of the bulk ticket discount program with COCC, with the aim of developing a group pass program. Demand for the existing program has exceeded the levels for which it was designed/intended.	CET ¹ , COCC ²	✓	

Responsibility: 1 = Lead, 2=Support

Table 4. PTP Implementation Actions (Continued)

Action #	Recommended Actions	Lead Implementer(s)	Short-Term	Long-Term
	Facilities & Infrastructure			
2.4	Adopt bus stop amenity design standards, e.g., based on PTP Figure 8-4. This should include standards for new bus shelters that enhance transit visibility and meet passenger needs for weather protection. This could also be addressed in the community-oriented design process described in item 2.4 (below). Pursue opportunities to integrate advertising or sponsorships as part of the funding package for shelters or other stop enhancements.	CET ¹ , City of Bend ² , BMPO ²	✓	
2.5	Develop specifications for new/replacement vehicles that modernize the fleet in order to be more appealing and attractive to a broad range of users and align vehicle capacity to passenger demand/needs on each route. This could include transit signal priority, real-time passenger information, and other ITS capabilities, e.g., automated passenger counters (APCs). In the mid-term time frame (or beyond) this could include a community-oriented process to design vehicles (and other system elements) to community specifications (e.g., similar to Boulder, where such a process was embraced in development of the Hop, Skip, Jump, etc., local transit services; see PTP for details).	CET ¹		✓
2.6	Develop a program of transit-supportive capital improvements. This program should be coordinated with the City's Capital Improvement Plan (CIP), to identify and prioritize transit-supportive capital improvements around major transit nodes, primary transit corridors, and planned routes including: Bus stops at major intersections (both sides of the street) and amenities at the most highly used stops (using stop amenity thresholds in Figure 8-1 as a guideline). Bicycle/pedestrian improvements (e.g., street crossings serving stops and activity centers along arterial transit streets such as 3 rd Street and Greenwood Ave.) • Transit signal priority to allow buses to better maintain schedule on congested corridors.	City of Bend ¹ , CET ¹ , BMPO ² , ODOT ²	✓	Review/update every 2 years
2.7	Develop a sidewalk repair and infill program, with a specific emphasis on access to transit facilities.	City of Bend ¹ , BMPO ² , CET ²	✓	✓

Responsibility: 1 = Lead, 2=Support

Table 4. PTP Implementation Actions (Continued)

Action #	Recommended Actions	Lead Implementer(s)	Short-Term	Long-Term
2.8	Evaluate pedestrian safety and transit operational improvements for the on-street bus transfer facility at Hawthorne Station. This could include consideration of: (1) converting Hawthorne Avenue to exclusive transit and pedestrian use between 3 rd and 4 th Avenue, e.g., east of the Safeway driveway; (2) providing a mid-block crossing for use by passengers (e.g., raised pavement surface, pedestrian-activated lighting, etc.). A “neck-down” could be included in the design of the mid-block crossing, assuming it does not impact bus movements; (3) on-street parking on 4 th Avenue between Hawthorne and Greenwood, given current and future transit operations.	City of Bend ¹ , CET ² , BMPO ²	✓	✓
2.9	Evaluate locations and opportunities for major transit stops in north and south Bend, at existing or future stop locations. These locations may serve as secondary transit hubs, facilitating connections between local or regional routes (based on future service enhancements identified in this plan or the RTMP), as well as ride sharing. See Figure 8-1 and Figure 8-2 for locations and potential stop features.	CET ¹ , City of Bend ² , BMPO ²	✓	✓
2.10	Develop bike parking facilities, preferably covered, at secondary hub locations and other outlying stop locations. Recommended locations are identified in Figure 8-2.	CET ¹ , BMPO ² , City of Bend ² , ODOT ² , Commute Options ²	✓	✓
2.11	Evaluate feasibility of a bicycle-sharing program. Implement as feasible (based on an appropriate service model, partnerships, etc.). Bicycle sharing can serve “last-mile” connections to destinations beyond walking distance of transit stops and relieve capacity limitations for transporting bicycles in racks on buses.	BMPO ¹ , City of Bend ² , Commute Options ²		✓
2.12	Implement speed & reliability improvements on 3rd Street. Such investments could include signal timing, transit signal priority, and evaluating stop placement to minimize delay to buses. Bus routes on 3 rd should be able to complete a round trip within the scheduled time (currently 40 minutes; in the mid-term time frame, 30 minutes for south 3 rd Street [Route 1] and 60 minutes for north 3 rd Street [Route 4]).	City of Bend ¹ , ODOT ¹ , BMPO ² , CET ²		✓

Responsibility: 1 = Lead, 2=Support

Table 4. PTP Implementation Actions (Continued)

Action #	Recommended Actions	Lead Implementer(s)	Short-Term	Long-Term
	Service or Service-Related			
2.13	Implement short-term service improvements to Routes 4, 5, and 6. Conduct additional outreach to Route 5 and 6 passengers who will be affected by the changes. Create a temporary stop for outbound Route 6/inbound Route 5 on eastbound Greenwood at Purcell. Add this stop and existing temporary stops on 5 th Street to the program for developing permanent stops.	CET ¹	✓	
2.14	Implement near mid-term service and infrastructure improvements on Routes 3 and 11, timed with and contingent on a new OSU facility on SW Colorado with a projected enrollment of 5,000 students within the next several years. Pursue partnerships with OSU (and/or others) to fund the increase in operating costs for all-day Route 11 service as well as additional early-evening service.	OSU ¹ , COCC ¹ , CET ² , City of Bend ²		✓
2.15	Secure funding for and implement pedestrian access corridors from Bear Creek Road to Greenwood Avenue to support implementation of Route 7. This should include required traffic signals and/or protected pedestrian crossings (e.g., rapid flashing beacon) to connect access corridors to future stop locations. A map of existing/planned accessways is provided in Appendix B, Figure B-16.	City of Bend ¹ , ODOT ² , CET ²		✓
2.16	Review priorities for eliminating at-grade railroad crossings including consideration of when transit service on a corridor may be feasible/likely and whether the potential for delay at railroad crossings could preclude future transit service. For example, Cooley Road in northeast Bend and Reed Market Road in southeast Bend; the COACT Report on Central Oregon Rail Planning (2009) prioritized both the Cooley and Reed Market Road crossings as “High.”	City of Bend ¹ , CET ² , BMPO ²	✓	

Responsibility: 1 = Lead, 2=Support

Table 4. PTP Implementation Actions (Continued)

Action #	Recommended Actions	Lead Implementer(s)	Short-Term	Long-Term
Goal 3: Increase mobility, accessibility, and visibility of transit throughout the urban area				
	Regional Service Enhancements			
3.1	Utilize the Bend-La Pine Community Connector (Route 30) to provide a stop in Deschutes River Woods. Identify potential locations (e.g., Riverwoods Baptist Church initially and/or Riverwoods Country Store in longer-term) amenable to a stop location, assess feasibility, and negotiate a joint-use agreement. Secure funding for any infrastructure improvements needed at the Riverwoods Country Store (e.g., pave rear portion of parking lot) if this location is pursued in the longer-term. Note: Service to Riverwoods Baptist Church started on 11/26/2012.	CET ¹ , BMPO ²	✓	✓
3.2	Evaluate a Bend-Redmond Community Connector (Route 24) stop in the north part of Bend. An initial location could be the ODOT Park & Ride near the DMV office on 3 rd Street. In the longer-term, the stop could be co-located with a future major transit hub / secondary hub location in north Bend (see 2.9).	CET ¹ , BMPO ²	✓	✓
3.3	Evaluate a Bend-La Pine Community Connector (Route 30) stop in the south part of Bend. An initial location could be the existing Route 1 stops near Walmart. In the longer-term, the stop could be co-located with a future major transit hub / secondary hub location in south Bend (see 2.9).	CET ¹ , BMPO ²	✓	✓
3.4	Promote vanpools to dispersed employment sites. Identify opportunities for promoting vanpools to employment sites not currently served by the fixed-route system or located outside of Bend city limits (e.g., Bend Municipal Airport). Assess demand for such vanpools to serve regional demand in coordination with Community Connector routes as well as local demand.	Commute Options ¹ , CET ² , BMPO ²	✓	
3.5	Develop a region-wide volunteer driver program to fill a need for transportation connections not served by transit, i.e., outside service area or service days/times.	Commute Options ¹ , CET ²	✓	
	Marketing and Branding			
3.6	Market regular interlining of routes to passengers as a convenience feature. Initially, this item refers to marketing existing route interlining practices (e.g., route 1-3, 2-4, 5-6).	CET ¹	✓	✓

Responsibility: 1 = Lead, 2=Support

Table 4. PTP Implementation Actions (Continued)

Action #	Recommended Actions	Lead Implementer(s)	Short-Term	Mid-Term
3.7	Build upon the “open” transit data published in Google Transit. Make trip planning capabilities available on the CET, City of Bend, and Commute Options websites. Provide real-time transit arrival information including on mobile devices (when available). Market enhancements to online trip planning and real-time information to current and potential riders.	CET ¹ , City of Bend ² , BMPO ² , Commute Options ²	✓	✓
3.6	Develop capabilities for targeted communication with customers including on their mobile devices (via text messages, e-mail, social media, etc.), such as to provide updates on delays or snow routes.	CET ¹	✓	
3.7	Develop a plan to complete the transition from BAT to CET in all system branding, including vehicles and stops.	CET ¹ , City of Bend ²	✓	
3.8	Conduct a comprehensive assessment of CET’s marketing and branding and develop action plan. This could include an assessment and update of the Rider Guide, website, social media, bus stop materials, etc.	CET ¹ , BMPO ²	✓	
3.9	Review / update marketing materials on a regular basis. This could include recommended improvements outlined in the Marketing and Branding section of Chapter 8, such as enhancements of the Rider Guide and increased development of social media (assuming staff is able to monitor and keep sites up-to-date). In addition, consider marketing regular interlining of routes to passengers as a convenience feature.	CET ¹ , Commute Options ¹		Every 2 years
3.10	Develop marketing materials for service between Bend and Redmond Airport. Coordinate service with major flight departure/arrival times to the extent possible and place marketing materials at strategic locations.	CET ¹	✓	Annually
	Performance Standards			
3.11	▪ Evaluate use of automatic passenger counters (APCs) to enhance data collection capabilities. Based on outcome of evaluation, include APC technology in new vehicle acquisitions.	CET ¹	✓	✓
3.12	Develop strategies to reduce the high rate of cancellations (potentially related to the large number of subscription trips).	CET ¹	✓	

Responsibility: 1 = Lead, 2=Support

Table 4. PTP Implementation Actions (Continued)

Action #	Recommended Actions	Lead Implementer(s)	Short-Term	Long-Term
Goal 4: Provide infrastructure and land use planning to support transit				
4.1	Adopt a Primary Transit Corridors policy. This policy should identify corridors with the highest potential ridership (see Primary Transit Corridors map, Figure 7-4) where the City, BMPO, and CET will prioritize the highest level of transit service over time and where major transit-supportive land uses are encouraged to locate. This policy should be reviewed periodically to ensure the primary transit corridors reflect current and planned land use intensity.	City of Bend ¹ , BMPO ² , CET ²	✓	Every 5 years
4.2	Develop a transit overlay zoning ordinance and adopt it around primary transit corridors and/or major transit nodes (e.g., Hawthorne Station). The Future Opportunities memo provides a more in-depth discussion of elements that could be addressed in such an ordinance and other opportunities to incorporate transit-supportive elements into the existing City code.	City of Bend ¹ , BMPO ²	✓	
4.3	Require review of transit service needs as part of the development review process. Develop a protocol for integrating assessment of transit requirements (including involvement of CET staff, and funding contribution for staff time) into early review of development/land use proposals, particularly those with potentially significant impact on transit ridership and/or where the proposed use is located away from transit.	City of Bend ¹ , BMPO ² , CET ²	✓	
4.4	Coordinate public facility master plans (e.g., sewer, water, etc.) with priorities/opportunities for intensifying land use along primary transit corridors. In particular, consider prioritizing facility upgrades that would relieve capacity constraints and enable development.	City of Bend ¹ , BMPO ² , CET ²	✓	
4.5	Evaluate a mechanism to formalize developer contributions to funding for transit infrastructure.	City of Bend ¹ , BMPO ²	✓	

Responsibility: 1 = Lead, 2=Support

Chapter 9: Transportation Systems Management

Introduction

The Oregon Transportation Planning Rule defines transportation systems management (TSM) as the use of “techniques for increasing the efficiency, safety, capacity or level of service of a transportation facility without increasing its size.” Examples of TSM include physical roadway improvements (e.g. access management and channelization), operational improvements (e.g. traffic signal coordination and ramp metering), and the use of intelligent transportation systems.

This chapter includes goals and policies, forecasts and future needs, and strategies for applying transportation systems management to the Bend MPO. Intelligent transportation systems (ITS) play a large role in TSM and a separate planning effort was undertaken as part of the *Deschutes County ITS Plan Update*¹ to develop a 20-year deployment plan of ITS projects that improve the operations and management of the transportation network in Deschutes County with a focus on the Cities of Bend and Redmond. In addition to ITS other TSM strategies discussed in this chapter include access management, parking management, traffic signal management and operations, speed management, geometric improvements, value engineering, systems engineering, and asset management.

TSM Policies

The policies for transportation system management were developed based on a review of existing policies in other state, regional, and local plans such as the *Oregon Transportation Plan*, *Deschutes County Transportation System Plan*, *Deschutes County ITS Plan*, and *City of Bend Transportation System Plan*. These policies will help guide the future development and management of the transportation system.

1. Support the access management policies of the Oregon Department of Transportation along state highways.
2. Work with member jurisdictions and agencies to adopt legislation that protects the integrity of regional roadways by managing public and private accesses.
3. Work with member jurisdictions and agencies to develop parking regulations that support land use and travel demand and that also encourage the use of alternate modes.
4. Work with member jurisdictions and agencies to implement a comprehensive intelligent transportation system program per the *Deschutes County ITS Plan Update*.
5. Support efforts of member jurisdictions and agencies to update traffic signal and traffic signal control system hardware and software and implement signal timing strategies to optimize system efficiency for all modes.

¹ *Deschutes County ITS Plan Update*. Prepared for ODOT by DKS Associates and IBI Group, June 2011

6. Support efforts of member jurisdictions and agencies to remove traffic signals where an engineering study (based on *MUTCD* guidelines) demonstrates they are no longer warranted based on land use changes that have resulted in decreased travel demand.
7. Support efforts of member jurisdictions and agencies to install new traffic signals where an engineering study (based on *MUTCD* guidelines) shows they are warranted to support land use changes that have resulted in increased travel demand.
8. Work with member jurisdictions and agencies to investigate the feasibility of utilizing automated speed and red light enforcement at high accident locations to improve safety and reduce the manpower needed by law enforcement and adopt legislation as needed.
9. Support efforts of member jurisdictions and agencies to utilize traffic calming techniques to reduce travel speeds and cut-through traffic on roadways where traffic conditions do not match the roadway's intended design.
10. Encourage member jurisdictions and agencies to consider geometric improvements to enhance efficiency and provide safety for motorists, pedestrians, and bicycles.
11. Encourage member jurisdictions and agencies to consider using value engineering or systems engineering to deliver transportation projects more efficiently and cost-effectively.
12. Promote new technologies and strategies to effectively manage transportation assets including roadway pavement, bridges, right-of-way, public transportation facilities, traffic signals, ITS field devices, and other infrastructure to maximize functionality and prolong the lifetime of the transportation system.

Forecasts and Future Needs

Traffic congestion coupled with a large expected growth in population and travel demand (see Motor Vehicle chapter) impacts the mobility of travelers and freight throughout the Bend MPO. Congestion results in travel delay, reduced productivity, and a frustrated driving public. Over half of congestion is caused by non-recurring events as shown in Figure 9.1. TSM strategies are needed to reduce non-recurring congestion, and its negative impacts, to optimize systems operations and maximize the available capacity of the existing transportation infrastructure. During the development of the *Deschutes County ITS Plan Update* an extensive needs assessment was conducted through stakeholder interviews, questionnaires, and a workshop to identify regional needs in the following areas of interest:

- Travel and Traffic Management
- Public Transportation Management
- Emergency Management
- Information Management
- Maintenance and Construction Management

Although these needs were ultimately used to develop a phased implementation of ITS projects, the user needs identified were very broad and may also be addressed by TSM strategies other than ITS.

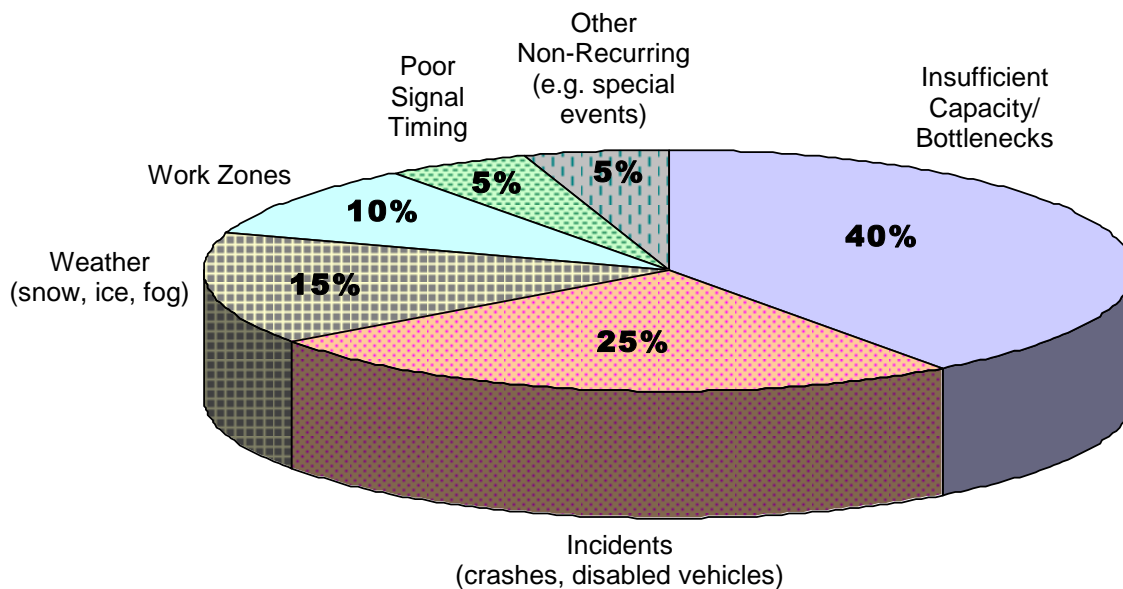


Figure 9.1 Causes of Congestion²

TSM Strategies

This section includes an overview of the strategies that may be used in the Bend MPO to support the transportation system management goals and policies listed earlier in this chapter. These strategies are discussed in the following management/operational areas: intelligent transportation systems, access management, parking management, traffic signal management and operations, speed management, geometric improvements, value engineering and systems engineering, and asset management.

Intelligent Transportation Systems

ITS involves the application of advanced technologies and proven management techniques to relieve congestion, enhance safety, provide services to travelers, and assist transportation system operators in implementing suitable traffic management strategies. ITS focuses on increasing the efficiency of existing transportation infrastructure, which enhances the overall system performance and reduces the need to add capacity (e.g., travel lanes). Efficiency is achieved by providing services and information to travelers so they can (and will) make better travel decisions and to transportation system operators so they can better manage the system. ITS technologies are used by agencies in the Bend MPO today and plans are in place to expand the use of ITS applications in the future.

In 2011, the Bend MPO, Oregon Department of Transportation (ODOT), Deschutes County, City of Bend, City of Redmond, Deschutes County 911, the Oregon State Police, and the Federal Highway Administration collectively developed the *Deschutes County ITS Plan Update* with input from other regional stakeholders. The mission of the

² Congestion Mitigation. Office of Operations, Federal Highway Administration.
<http://www.ops.fhwa.dot.gov/aboutus/opstory.htm>. Accessed June 26, 2014.

plan is “to improve the safety, security and movement of goods, people, and services for all modes of the transportation network by using advanced technologies, establishing agency coordination, utilizing existing system capacity and infrastructure, and providing real time traveler information.” The outcome of the plan is a phased 20-year deployment plan of ITS projects, a regional ITS architecture, and regional operational concept that all meet federal ITS requirements. Additionally, this effort is consistent with plans put together statewide and in other regions of Oregon to ensure that ITS strategies are integrated and complementary.

Benefits of ITS

ITS projects are aimed at improving the safety and operational efficiency of the existing transportation infrastructure by:

- Reducing vehicle delays related to recurrent and non-recurrent congestion
- Reducing collisions and incident response times
- Providing travelers with real-time information to make informed route and mode choice decisions.

Quantifiable benefits resulting from intelligent transportation systems include:

- Reduced vehicle delays
- Reduced number of collisions
- Improved air quality
- Reduced fuel consumption
- Improved travel times

Other accrued benefits, which are more difficult to quantify, include improved travel time reliability, reduced driver frustration, and reduced driver anxiety from having real-time travel information. Additionally, improved efficiency due to coordinated and cooperative agency actions can produce long term savings, particularly in relation to coordinating regional projects and a coordinated regional response to incidents. ITS deployments around the state of Oregon have yielded many of these; some of these benefits are highlighted herein.

ODOT Region 2 Incident Management Program

- 15-percent reduction in average incident duration
- 35-percent reduction in vehicle-hours incident delay

Traveler Information

- 7- to 12-percent reduction in travel time
- Up to 33-percent reduction in emissions

ITS Projects for Bend MPO

A list of ITS projects was developed to meet the regional needs and then phased based on a scoring exercise (criteria included items such as safety, congestion mitigation, and key traveler decision points), cost, expected benefits, technical and institutional feasibility, relativity to other planned projects, input from the Steering Committee, and equitable distribution. The resulting deployment plan includes the following phases:

- 2014 – 2018: 0 – 5 Year Plan (Short-term)
- 2019+: 5+ Year Plan (Long-term)

Table 9.1 lists the projects that fall within the Bend MPO and are anticipated to be feasible within projected funding levels. Table 9.2 lists additional aspirational projects that have been identified in the Deschutes County ITS Plan, but are not anticipated to be achievable under projected funding sources. A map illustrating the phased ITS infrastructure deployment locations for many of the ITS projects is located in Appendix E. Many of the projects will be implemented by multiple jurisdictions and several projects will deploy systems that will be shared beyond the Bend MPO. ODOT plans to pursue a number of statewide ITS initiatives that may be applied to the Bend area and will support some of the projects included in Table 9.1³.

The ITS projects included in Table 9.1 utilize the following general strategies to improve the operational efficiency and management of the Bend area transportation network:

- Corridor management on key corridors that includes traffic signal coordination, remote monitoring, and traveler information dissemination
- Rail warning systems
- Parking management
- Transit system management
- Multi-jurisdictional programs for traffic management, incident response, emergency management, and maintenance and construction management
- Regional traveler information dissemination

³ *Oregon Statewide ITS Architecture and Operational Concept Plan*. Prepared for ODOT by DKS Associates, May 2012.

Table 9.1 ITS Deployment Projects for Bend MPO

#/Title	Description (<i>stakeholders listed at end</i>)	Capital Cost
2014 – 2018 (0 – 5 Year Plan, Short-term)		
DC-TM-02A: Region 4 TOC to 3 rd St RWIS	<ul style="list-style-type: none"> • Install fiber optic cable along 3rd Street/The Dalles-California Highway between Region 4 TOC and Division Street, use existing conduit between OB Riley Road and the RWIS near the Bend Parkway • Upgrade traffic signal controllers at: <ol style="list-style-type: none"> 1. 3rd Street/The Dalles-California Highway/NE Bed River Mall Drive 2. 3rd Street/The Dalles-California Highway/OB Riley Road 3. 3rd Street/The Dalles-California Highway/Mt Washington Drive/Butler Market Road 4. 3rd Street/The Dalles-California Highway/Division Street • Connect to existing cameras as 3rd Street/The Dalles-California Highway/Mt Washington Drive/Butler Market Road (<i>ODOT, Bend</i>) 	\$330,000 to \$710,000
DC-TM-02B: Bend Pkwy and 3 rd St: Reed Market Rd to Murphy Rd (Stage 1)	<ul style="list-style-type: none"> • Subscribe to leased services between ODOT Region 4 TOC and communications hub TBD between Reed Market Road and Murphy Road • Install VDSL in existing conduit and existing aerial route along 3rd Street/The Dalles-California Highway between Reed Market Road and Power Road • Install fiber optic cable in existing conduit along Powers Road between 3rd Street/The Dalles-California Highway Bend Parkway • Install fiber optic cable in existing conduit along Bend Parkway between Powers Road and Murphy Road • Upgrade traffic signal controllers at: <ol style="list-style-type: none"> 1. Bend Parkway/Powers Road 2. Bend Parkway/Pinebrook Boulevard 3. Bend Parkway/3rd Street/The Dalles-California Highway • Install PTZ cameras at <ol style="list-style-type: none"> 1. Bend Parkway/Powers Road 2. Bend Parkway/3rd Street/The Dalles-California Highway (<i>ODOT, Bend</i>) 	\$140,000 to \$160,000
DC-TM-19A: Advanced Rail Warning System - Reed Market Road	Bend (Reed Market Road at 3rd Street, Railroad crossing, and 15th Street). Includes transmitting advanced crossing occupancy information to the public via message signs or in-vehicle navigation systems. (<i>ODOT, Bend, Redmond, Deschutes County, 911 Center</i>)	\$310,000
DC-TM-28: City of Bend Traffic Data Collection	Deploy video traffic counting stations at bottleneck locations (e.g. Portland Street Bridge) to monitor traffic and collect traffic volume data. (<i>Bend</i>)	\$110,000

#/Title	Description (<i>stakeholders listed at end</i>)	Capital Cost
DC-TM-29: Revere Ave and Wall St to 3rd St and Greenwood Ave (Hwy 20)	<ul style="list-style-type: none"> Subscribe to leased services between ODOT Region 4 TOC and new communications hub at NW Revere Avenue/NW Wall Street Install fiber optic cable: <ol style="list-style-type: none"> Use existing conduit along Revere Avenue between NE Wall Street and 3rd Street/The Dalles-California Highway On existing aerial route along 3rd Street/The Dalles-California Highway between Revere Avenue and Greenwood Avenue Connect to existing interconnect to: <ol style="list-style-type: none"> NE Wall Street/NW Portland Avenue/NW Olney Avenue 3rd Street/The Dalles-California Highway/Franklin Avenue Upgrade traffic signal controllers at: <ol style="list-style-type: none"> NW Revere Avenue/NW Wall Street/Bend Parkway southbound ramps NW Revere Avenue/NE Division Street/Bend Parkway northbound ramps 3rd Street/The Dalles-California Highway/Olney Avenue Install PTZ cameras at: <ol style="list-style-type: none"> 3rd Street/The Dalles-California Highway/Olney Avenue 3rd Street/The Dalles-California Highway/Greenwood Avenue (<i>ODOT, Bend</i>) 	\$370,000 to \$550,000
DC-PTM-01: Automated Vehicle Location (AVL)/Computer Aided Dispatch (CAD) Transit Management System	Install an automated vehicle location (AVL) system on the CET fleet and replace existing computer aided dispatch (CAD) system. (<i>CET</i>)	\$590,000
DC-PTM-03: Real-Time Customer Information	<p>Disseminate transit traveler info to internet and personal user devices.</p> <p>Deploy real-time dynamic message signs at key locations such as transit centers and bus stops where multiple routes pass through, and at stops with large bus headways. (<i>CET.</i>)</p>	\$90,000
DC-PTM-06: Automated Passenger Counting	Install an automated passenger counting system that electronically records boardings and alightings at each transit stop (<i>CET</i>)	\$110,000
DC-EM-01A: Coordinated Emergency Response - Radio System Link	Provide a two-way information flow (i.e.. CCTV camera images, congestion flow map, emergency calls) between transportation management systems and the 911 and emergency dispatch centers. This project will integrate the transportation information with existing computer aided dispatch systems and the emergency data with traffic management systems. (Oregon Interoperability Service (OIS) is currently underway). (<i>ODOT, Bend, Redmond, Deschutes County, Deschutes County 911, US Forest Service</i>)	\$550,000
DC-EM-02: Coordinated Emergency Response - Radio System Link	Deploy a common communication interface between stakeholders responsible for emergency management. This project supports coordinated emergency response for evacuation routes and disaster response. (<i>ODOT, Bend, Redmond, Deschutes County, Deschutes County 911, US Forest Service</i>)	Funded by Reg. Comm. Consortium
DC-MC-02: Work Zone Management and Safety Monitoring Systems	Deploy work zone safety enhancements and management techniques including variable speed limits, incident detection and management, lane merge controls, travel time estimates and queue detection with electronic feedback signs. (<i>ODOT</i>)	Funded with construction projects

#/Title	Description (<i>stakeholders listed at end</i>)	Capital Cost
DC-PP-06: Roundabout Preemption (previously DC-EM-10)	Implement an emergency vehicle preemption system for roundabouts located on primary response routes. ● Priority at Reed Market Road/SE 15th Street (where the existing signal will be reconstructed as a roundabout with an upcoming City Project) is high (<i>Bend</i>)	\$600,000
DC-PP-07: Automatic Vehicle Location Equipment Pilot Project (snowplows)	Test the use of automatic vehicle location devices on snowplows in District 10.	\$20,000
Capital Cost for 2014 – 2018		\$3,220,000 to \$3,800,000
2019 + (5+ Year Plan, Long-term)		
DC-TM-02D: Hwy 97 Business (3rd Street) - Travel Time Performance Measurements	This project will deploy devices to measure travel times for traveler information and performance measurement assessment. (<i>ODOT, Bend</i>)	\$335,000
DC-TM-07A: Hwy 20/Greenwood from 15th St to Purcell Blvd	<ul style="list-style-type: none"> ● Subscribe to leased services between ODOT Region 4 TOC and new communications hub at Greenwood Avenue/SE 15th Street ● Install fiber optic cable along Greenwood Avenue between 15th Street and Purcell Boulevard ● Upgrade traffic signal controller at Greenwood Avenue/15th Street ● Possible inter-agency communications with Bend Area Transit, Bend Police, and City of Bend Public Works (<i>ODOT, Bend</i>) 	\$185,000 to \$315,000
DC-TM-07D: Hwy 20/Greenwood/Newport - Travel Time Performance Measurements	This project will deploy devices to measure travel times for traveler information and performance measurement assessment. (<i>ODOT, Bend</i>)	\$270,000
DC-TM-08E: Hwy 97 (Bend Parkway) - Travel Time Performance Measurements	This project will deploy devices to measure travel times for traveler information and performance measurement assessment. (<i>ODOT, Bend</i>)	\$210,000
DC-TM-09: Century Drive (to Mt. Bachelor) Safety and Efficiency Improvements	This project will deploy video, electronic message signs, weather stations, dynamic speed limit signs, and speed photo enforcement on Century Drive between Bend and Mt. Bachelor (<i>ODOT, Bend, Mt. Bachelor Inc.</i>)	\$820,000
DC-TM-10: Incident Response Program - Staff and Vehicles	Develop a multi-jurisdictional regional incident response program to support emergency management agencies with incident management on state, county, and city roadways. This program includes vehicles, personnel, and dispatch. This program will coordinate with ODOT maintenance crew incident responders to maximize efficiency and pool resources. (<i>ODOT, Bend, Redmond, Deschutes County</i>)	\$960,000
DC-TM-11B: Hwy 97 (Bend to Redmond) Safety and Efficiency Improvements	This project will deploy video to support incident management and traveler information. (<i>ODOT</i>)	\$130,000
DC-TM-12A: Hwy 97 (South of Bend) Safety and Efficiency Improvements	This project will deploy a video, electronic message signs, and weather stations. (<i>ODOT</i>) – PARTIALLY COMPLETE	Funded with STIP

#/Title	Description (<i>stakeholders listed at end</i>)	Capital Cost
DC-TM-12B: Hwy 97 (South of Bend) Safety and Efficiency Improvements	This project will deploy a variable speed limit system. (<i>ODOT</i>)	\$60,000
DC-TM-13A: 27 th /Empire/Knott Safety and Efficiency Improvements	This project will deploy video monitoring cameras with pan-tilt-zoom control, count stations, and advanced signal timing improvements. (Signal timing improvements on 27 th Street completed in 2011). (<i>ODOT, Bend</i>)	\$440,000
DC-TM-14: ODOT Region 4 TOC Upgrade	Expand/upgrade the existing TOC facility and equipment. (<i>ODOT</i>)	\$95,000
DC-TM-19B: Advanced Rail Warning System - Bend and Redmond locations	Bend (County Club Rd, Olney Ave, Revere Ave, Wilson Avenue), Redmond (Airport Way, Sisters Ave, Antler Ave) (<i>ODOT, Bend, Redmond, Deschutes County, 911 Center</i>)	\$190,000
DC-TM-34: Franklin Avenue: 3rd Street to Bond Street	<ul style="list-style-type: none"> • Install fiber optic cable on Franklin Avenue between 3rd Street and NW Wall Street • Possible inter-agency communications with Bend City Hall (<i>Bend</i>) 	\$100,000 to \$800,000
DC-TM-35: 27th Street Corridor Upgrade	<ul style="list-style-type: none"> • Install fiber optic cable in existing conduit along 27th Street between Bear Creek Road and Neff Road • Install fiber optic cable in existing conduit along Neff Road between 27th Street and Purcell Boulevard (may need to install conduit between Medical Center Drive and Purcell Boulevard). (<i>Bend</i>) 	\$170,000 to \$270,000
DC-TM-36: Wall Street: Greenwood Avenue to Portland Ave/Olney Ave	<ul style="list-style-type: none"> • Install fiber optic cable along NW Wall Street between NW Portland Ave/NW Olney Ave and Greenwood Ave (<i>Bend</i>) 	\$130,000 to \$400,000
DC-TM-37: Remaining 170 to 2070 upgrades	<ul style="list-style-type: none"> • Upgrade traffic signal controllers at: <ol style="list-style-type: none"> 1. NE Butler Market Road/NE Boyd Acres Road 2. NE 8th Street/NE Penn Avenue (<i>Bend</i>)	\$30,000 to \$70,000
DC-TM-38: Wall Street: Revere Avenue to Portland Ave/Olney Ave	<ul style="list-style-type: none"> • Install fiber optic cable in existing conduit along NW Wall Street between NW Revere Avenue and NW Portland Avenue/NW Olney Avenue • Upgrade traffic signal controller at NW Wall Street/NW Portland Avenue/NW Olney Avenue (<i>Bend</i>)	\$45,000 to \$50,000
DC-TM-40: Count Stations - Bridges	<p>Install count stations at several of the bridge over the Deschutes River:</p> <ul style="list-style-type: none"> • Reed Market Road • Colorado Avenue • Columbia Street • Galveston Avenue • Newport Avenue • Mt Washington Drive • Archie Briggs Road <p>Count stations should collect the following data: vehicle volumes, vehicle classifications, and vehicle speeds. (<i>Bend</i>)</p>	\$150,000

#/Title	Description (<i>stakeholders listed at end</i>)	Capital Cost
DC-TM-41: Count Stations - City Outskirts	Install count stations that support locations near Bend city limits in the travel demand model: <ul style="list-style-type: none"> • Powell Butte Highway • Century Drive • Shevlin Park Road • Skyliners Road • Cline Falls Highway • Old Bend-Redmond Highway • Knott Road <p>Count stations should collect the following data: vehicle volumes, vehicle classifications, and vehicle speeds. (<i>Bend</i>)</p>	\$150,000
DC-PTM-02: Maintenance Management System	Upgrade the existing fleet maintenance system to expand functionality and meet FTA requirements. (<i>CET</i>)	\$40,000
DC-PTM-07: Electronic Fare System linked to Smart Cards	Install an electronic fare collection system that includes Smart Card support (linked to Bend Parking Garage Smart Cards). (<i>CET, Bend</i>)	\$25,000
DC-EM-03: Real-Time Information to mobile data devices	Provide real-time traffic information to emergency responders' mobile data devices. (<i>ODOT, Bend, Redmond, Deschutes County, Deschutes County 911, Oregon State Police</i>)	\$120,000
DC-EM-06: Provide Traffic Management System Information at EOCs	Provide an interface between the TOC and/or other traffic management systems and each of the emergency operations centers to allow access to traffic control devices during emergency situations at the EOCs as well as to share information between agencies. This would include workstations, monitors, and a communications interface at EOCs. (<i>ODOT, Bend, Redmond, Deschutes County, Deschutes County 911</i>)	\$80,000
DC-IM-01: Regional Data Management System	Implement a data management system for archiving data, collecting real-time data, and accessing data. The system should have geospatial capabilities and data should include at a minimum traffic counts, speed data, accidents (vehicles, pedestrians, and bicycles), traffic enforcement data, incident information, and transit information. (<i>ODOT, Deschutes County, Bend, Redmond</i>)	\$540,000
DC-MC-03: Roadway Automated Treatment	Includes environmental sensors and automated treatment (de-icing) at the planned US 97/S. Century Drive interchange. (<i>ODOT</i>)	Funded with STIP
Capital Cost for 2018+		\$7,585,000 to \$8,830,000

Source: *Deschutes County ITS Plan Update*

Table 9.2 ITS Aspirational Projects (Beyond Projected Funding Levels) for Bend MPO

#/Title	Description (<i>stakeholders listed at end</i>)	Capital Cost
No Implementation Target Identified (Beyond Projected Funding Levels)		
DC-TM-02C: Bend Pkwy and 3rd St: Reed Market Rd to Murphy Rd (Stage 2)	<ul style="list-style-type: none"> • Install fiber optic cable in existing conduit and existing aerial route along 3rd Street/The Dalles-California Highway between Reed Market Road and Powers Road • Install fiber optic cable in existing conduit along Powers Road between 3rd Street/The Dalles-California Highway Bend Parkway • Install fiber optic cable in existing conduit along Bend Parkway between Powers Road and Murphy Road • Salvage removed VDSL equipment from 3rd Street/The Dalles-California Highway, Powers Road, and Bend Parkway for use on State Highway 372/Colorado-Arizona Couplet (<i>ODOT, Bend</i>) 	\$240,000 to \$360,000
DC-TM-02E: Hwy 97 Business (3rd Street) - Dynamic Message Signs	This project will deploy dynamic message signs. (<i>ODOT, Bend</i>)	\$315,000
DC-TM-06: Downtown Bend Parking Management System	This project would monitor parking garage occupancy to alert travelers if the garage is full and provide guidance to alternate available parking. (<i>Bend</i>)	\$150,000
DC-TM-07B: Hwy 20/Greenwood Ave from 3rd St to 8th St	<ul style="list-style-type: none"> • Install wireless along NE Greenwood Avenue between 3rd Street/The Dalles-California Highway and 8th Street • Upgrade traffic signal controller at NE Greenwood Avenue/8th Street • Install PTZ camera at NE Greenwood Avenue/8th Street (<i>ODOT, Bend</i>) 	\$50,000 to \$445,000
DC-TM-07C: Hwy 20/Greenwood from Purcell to 27th Ave	<ul style="list-style-type: none"> • Install fiber optic cable in existing conduit along Greenwood Avenue between Purcell Boulevard and 27th Street • Connect to existing interconnect along 27th Street • Install PTZ cameras at: <ol style="list-style-type: none"> 1. Greenwood Avenue/15th Street 2. Greenwood Avenue/Purcell Blvd 3. Greenwood Avenue/27th Street (<i>ODOT, Bend</i>)	\$100,000 to 150,000
DC-TM-07E: Hwy 20/Greenwood - Dynamic Message Signs	This project will deploy dynamic message signs. (<i>ODOT, Bend</i>)	\$150,000
DC-TM-08A: Bend Pkwy from Hwy 372/Colorado Ave to Reed Market Rd	<ul style="list-style-type: none"> • Install fiber optic cable along Bend Parkway between Colorado Avenue/State Highway 372 and Reed Market Road • Install PTZ camera on Bend Parkway north of Reed Market Road • Connect to existing PTZ camera near Colorado Avenue/State Highway 372 (<i>ODOT, Bend</i>) 	\$380,000 to \$580,000
DC-TM-08B: VMS: Bend Parkway northbound at Empire	<ul style="list-style-type: none"> • Install variable message sign on Bend Parkway northbound at Empire Boulevard (<i>ODOT, Bend</i>) 	\$250,000 to \$350,000
DC-TM-08C: Bend Parkway: Revere Avenue to Franklin Avenue	<ul style="list-style-type: none"> • Install fiber optic cable along Bend Parkway between hub at Revere Avenue/Wall Street and Franklin Avenue (<i>ODOT, Bend</i>) 	\$290,000 to \$590,000

#/Title	Description (<i>stakeholders listed at end</i>)	Capital Cost
DC-TM-08D: Bend Parkway: Empire Avenue to Cooley Road	<ul style="list-style-type: none"> ● Install fiber optic cable along Bend Parkway between Empire Ave and Cooley Ave ● Connect to existing interconnect along Robal Road ● Upgrade traffic signal controller at Robal Road/Berg Lane (<i>ODOT, Bend</i>) 	\$400,000 to \$1,500,000
DC-TM-11C: Hwy 97 (Bend to Redmond) Safety and Efficiency Improvements	This project will deploy electronic message signs to support incident management and traveler information. (<i>ODOT</i>)	\$320,000
DC-TM-11D: VMS: The Dalles-California Highway northbound at Cooley	<ul style="list-style-type: none"> ● Install variable message sign on The Dalles-California Highway northbound at Cooley Road ● On hold pending US 97 Bend North Corridor EIS (<i>ODOT, Bend</i>) 	\$250,000 to \$350,000
DC-TM-12C: Hwy 97 (South of Bend) Safety and Efficiency Improvements	This project will deploy video monitoring camera(s) with pan-tilt-zoom control near the ODOT weigh in motion station south of Bend. (<i>ODOT</i>)	\$30,000
DC-TM-13B: Northeast Ring: 27th to Empire	<ul style="list-style-type: none"> ● Install fiber optic cable along NE 27th Street between NE Neff Road and NE Butler Market Road ● Install fiber optic cable along Empire Avenue between Region 4 TOC and NE Purcell Boulevard ● Install fiber optic cable along future Empire Avenue extension between NE Purcell Boulevard and NE 27th Street ● Install fiber optic cable along NE Purcell Boulevard between Empire Avenue and NE Butler Market Road traffic signal ● Project provides a redundant path back to the ODOT Region 4 TOC and communications for future traffic signals (<i>ODOT, Bend</i>) 	\$850,000 to \$3,300,000
DC-TM-16: Hwy 20 (Bend to Sisters) Safety and Efficiency Improvements	Hwy 20 (Bend to Sisters) Safety and Efficiency Improvements (<i>ODOT</i>)	\$1,030,000
DC-TM-17A: Reed Market Road from Bend Pkwy to 3rd St	<ul style="list-style-type: none"> ● Install fiber optic cable along Reed Market Road between Bend Parkway southbound ramps traffic signal and 3rd Street/The Dalles-California Highway ● Upgrade traffic signal controller at Reed Market Road/Bend Parkway southbound ramps ● Connect to existing interconnect along 3rd Street/The Dalles-California Highway to Wilson Avenue ● Install PTZ camera on Bend Parkway south of Reed Market Road ● Install wireless communications to PTZ camera (<i>ODOT, Bend</i>) 	\$190,000 to \$440,000
DC-TM-17B: Reed Market Road: 3rd Street to 27th Street	<ul style="list-style-type: none"> ● Install fiber optic cable along Reed Market Road between 3rd Street and 27th Street ● Consider combining with Reed Market Road project Key #14210 ● Project provides a redundant path and communications to traffic signals at: <ol style="list-style-type: none"> 1. Reed Market Road/SE 9th Street 2. Reed Market Road/SE 27th Street 3. Reed Market Road/SE 15th Street (<i>Bend</i>) 	\$590,000 to \$1,060,000
DC-TM-17C: Reed Market Road - Travel Time Performance Measurements	This project will deploy devices to measure travel times for traveler information and performance measurement assessment. (<i>ODOT, Bend</i>)	\$40,000

#/Title	Description (<i>stakeholders listed at end</i>)	Capital Cost
DC-TM-18: Expand the Incident Response Program - Plans	This project supports incident management in Deschutes County and includes identification of detour routes, management of traffic on Highway 97 and Highway 20 through Bend and Redmond to support the movement of north-south and east-west freight through Oregon. The program will include incident signal timing plans, electronic message signs, and congestion monitoring to support the incident responders and management of the roadway network during incidents. (<i>ODOT, Bend, Redmond, Deschutes County</i>)	\$420,000
DC-TM-19C: Advanced Rail Warning System - Additional Bend and Redmond locations	Bend (China Hat Road, Brosterhous Rd, Cooley Rd), Redmond (Hemlock Ave, King Way) (<i>ODOT, Bend, Redmond, Deschutes County, 911 Center</i>)	\$130,000
DC-TM-19D: Advanced Rail Warning System - Message signs and in-vehicle communications	Transmit advanced crossing occupancy information to the public via message signs or in-vehicle navigation systems (assumes 12 VMS signs and 12 local transmission devices for in-vehicle navigation). (<i>ODOT, Bend, Redmond, Deschutes County, 911 Center</i>)	\$1,350,000
DC-TM-30: State Highway 372/Colorado-Arizona Couplet	<ul style="list-style-type: none"> • Install fiber optic cable between Bend Parkway and traffic signal at Colorado Avenue/State Highway 372/Bend Parkway southbound ramps • Install VDSL on existing twisted pair to traffic signals along Colorado-Arizona Couplet • Upgrade traffic signal controllers at: <ol style="list-style-type: none"> 1. NW Colorado Avenue/State Highway 372/Bend Parkway southbound ramps 2. NW Colorado Avenue/State Highway 372/NW Bond Street 3. NW Colorado Avenue/State Highway 372/NW Wall Street 4. NW Colorado Avenue/State Highway 372/SW Industrial Way 5. NW Arizona Avenue/State Highway 372/NW Wall Street 6. NW Arizona Avenue/State Highway 372/NW Bond Street (<i>ODOT, Bend</i>) 	\$100,000 to \$150,000
DC-TM-31: VMS: McKenzie-Bend Highway westbound at Cooley	<ul style="list-style-type: none"> • Install variable message sign on McKenzie-Bend Highway westbound at Cooley (<i>ODOT, Bend</i>) 	\$250,000 to \$350,000
DC-TM-32: Communications to Remote Traffic Signals	<ul style="list-style-type: none"> • Install communications to: <ol style="list-style-type: none"> 1. Existing traffic signal at NE Butler Market Road/NE Boyd Acres Road 2. Existing traffic signal at NE 8th Street/NE Penn Avenue 3. Possible future traffic signal at NE Butler Market Road/NE 4th Street 4. Possible future traffic signal at SE Wilson Avenue/SE 9th Street. (<i>Bend</i>) 	\$70,000 to \$200,000

#/Title	Description (<i>stakeholders listed at end</i>)	Capital Cost
DC-TM-33: Wall Street and Bond Street Wireless	<ul style="list-style-type: none"> • Install wireless on NW Wall Street and NW Bond Street between Greenwood Avenue and Franklin Avenue • Upgrade traffic signal controllers at: <ol style="list-style-type: none"> 1. NW Wall Street/Greenwood Avenue 2. NW Wall Street/NW Oregon Avenue 3. NW Wall Street/Franklin Avenue 4. NW Bond Street/Greenwood Avenue 5. NW Bond Street/NW Oregon Avenue 6. NW Bond Street/Franklin Avenue • Possible inter-agency communications with Bend City Hall (<i>Bend</i>) 	\$140,000 to \$670,000
DC-TM-42: Speed Photo Enforcement	Install speed photo enforcement at the following locations: <ul style="list-style-type: none"> • Mt Washington Drive, south of Simpson • Empire Avenue, east of Boyd Acres • Brookwood Boulevard, south of Powers Road (<i>Bend</i>) 	\$420,000
DC-TM-45: Red Light Cameras	Install red light cameras at the following locations: <ul style="list-style-type: none"> • 3rd Street/Reed Market Road • 3rd Street/Franklin • 3rd Street/Greenwood • 3rd Street/Empire • Powers Road/US 97 (<i>Bend</i>) 	\$700,000
DC-EM-01B: Deschutes County 911 Communications	<ul style="list-style-type: none"> • Install fiber optic cable along 3rd Street/The Dalles-California Highway and Jamison Road or McKenzie-Bend Highway between Empire Avenue and Deschutes County 911 facility • Connect to Deschutes County 911 • Connect to existing PTZ camera near Bend Parkway/Highway 20 interchange • Possible inter-agency communications with Bend Fire Department, Deschutes County Sheriff, and Oregon State Police (<i>Deschutes County</i>) 	\$240,000 to \$870,000
DC-EM-05: Traffic Adaptive Emergency Response	Deploy an integrated emergency response system that provides for pre-trip planning, en-route guidance (static route plan), and dynamic route guidance (traffic-adaptive route plan) for emergency vehicles. (<i>ODOT, Bend, Redmond, Deschutes County, Deschutes County 911</i>)	\$390,000
DC-EM-07: Responder Video System	Provide emergency responders with video cell phones and develop a link to the TOC to link video to other agencies. (<i>ODOT, Bend, Redmond, Deschutes Co., OSP</i>)	\$30,000
DC-EM-09: Advanced Emergency Vehicle Routing	Provide emergency vehicle priority between St. Charles Hospital and the Bend Airport. (<i>ODOT, Bend, Redmond, Deschutes County</i>)	\$70,000
DC-IM-01: Regional Data Management System	Implement a data management system for archiving data, collecting real-time data, and accessing data. The system should have geospatial capabilities and data should include at a minimum traffic counts, speed data, accidents (vehicles, pedestrians, and bicycles), traffic enforcement data, incident information, and transit information. (<i>ODOT, Bend, Redmond, Deschutes County</i>)	\$540,000
DC-MC-04: Portable Construction Zone Equipment	Deploy moveable dynamic message signs and variable speed limit signs for use in work zones. (<i>ODOT, Bend, Redmond, Deschutes County</i>)	\$340,000

#/Title	Description (<i>stakeholders listed at end</i>)	Capital Cost
DC-MC-05: Maintenance Vehicle Tracking	Deploy GPS/AVL equipment in maintenance vehicles (e.g. snow plows). Provide route information for coordinating maintenance between agencies. Additional functionality could include environmental sensors (e.g. road temperature) (<i>ODOT, Bend, Redmond, Deschutes County</i>)	\$780,000
DC-MC-06: Automated Maintenance Logging System	Implement a system to automate coding of maintenance needs (e.g. potholes, wildlife removal, damaged signs) from vehicles. (<i>ODOT, Bend, Redmond, Deschutes County</i>)	\$100,000
DC-MC-07: Portable Sidewalk Closure Message System	Develop and deploy a sidewalk closure audible message system to re-route pedestrians and meet ADA requirements. (<i>Bend</i>)	\$35,000
DC-PP-01: Road Weather Conditions (previously DC-AVS-01)	Install short-range communications equipment at weather stations to transmit road conditions (pavement temperature) to vehicles. (<i>ODOT, Deschutes County</i>)	\$410,000
DC-PP-02: Congestion Warning System (previously DC-AVS-02)	Deploy warning systems devices at entry points into urban areas to warn drivers of upcoming signals/queues. (<i>ODOT</i>)	\$300,000
DC-PP-03: Intersection Collision Avoidance (previously DC-AVS-03)	Install short-range communications to transmit traffic controller information to in-vehicle collision avoidance systems. (<i>ODOT, Bend, Redmond</i>)	\$1,400,000
DC-PP-04: Wildlife Detection (previously DC-AVS-04)	Deploy wildlife detection equipment and short-range communications to transmit warnings to in-vehicle systems. (<i>ODOT, Deschutes County</i>)	\$340,000
DC-PP-05: Ambulance-Hospital Information System (previously DC-EM-04)	Enable the exchange of real-time information (video, audio, and data) between first responders and hospitals through the regional communication network (St. Charles microwave communication system). (<i>St. Charles Hospital, Deschutes County, Bend, Redmond</i>)	Funded by St. Charles and Deschutes County
Capital Cost for Aspirational Projects		\$14,180,000 to \$21,155,000
Source: <i>Deschutes County ITS Plan Update</i>		

Access Management

The two main functions of a roadway are to:

- 1) provide access to adjacent properties, and
- 2) provide mobility to travelers.

Access management is the practice of balancing access and mobility based on a roadway's functional classification while also preserving the safety and efficiency of the transportation system. For instance, few access points are provided along interstate freeways to provide for high-speed travel while numerous access points are provided on local streets as entry points to residential properties. Research has shown that effective access management can provide the following benefits⁴:

- Up to 50-percent reduction of crashes
- 23- to 45-percent increase in roadway capacity
- 40- to 60-percent reduction in travel time and delay

Jurisdictions within the Bend MPO should adopt access management standards and develop access management plans along arterial and collector roadways that include some of the following strategies:

- Regulate access spacing minimums based on functional classification: between public roadways, between private approaches, and between public roadways and private approaches.
- Regulate spacing between traffic signals.
- Limit the number of approaches per property frontage based on development type and size.
- Regulate the width, apron size, radii, and vertical geometry of approaches based on development type.
- Limit access to the lower functionally classified roadway for properties that abut more than one roadway.
- Require developers to provide site designs with adequate internal circulation.
- Provide incentives for adjacent properties to share access points and provide circulation between properties.
- Develop guidelines for the use of median treatments: continuous two-way left turn lanes and non-traversable medians

At a minimum ODOT's access management policies should be met along state highways. More stringent standards may be developed if deemed applicable by the local jurisdiction.

Access management plans for implementation along specific corridors should include both short-term and long-term strategies. Since strict adherence to the adopted access management standards may adversely affect or limit access to existing land uses (particularly businesses), it is extremely important to work individually with each property owner to meet their access needs. The short-term access management plan should include strategies for improving approach locations and circulation for the

⁴ *Access Management Manual*. Transportation Research Board, National Academy of Sciences, 2003.

existing properties along a corridor while also working towards the adopted access management standards, improved safety, and better efficiency. The long-term access management plan should include strategies for access and circulation that may be applied if and when new development or redevelopment occurs in the future so that the plan may be used to gradually improve safety and roadway operations as opportunities arise.

Parking Management

Parking, whether on-street (curbside) or off-street (parking lots and garages), is an important aspect of the transportation system because motorists must physically store their vehicles somewhere in between trips. The management of parking can have significant impacts on the safety and efficiency of the transportation network. Although on-street parking often provides convenient access to adjacent land uses it is responsible for approximately one out of every five non-freeway accidents in cities every year⁵. It also reduces the capacity of the roadway by approximately one-third because the act of parking a vehicle and the presence of vehicle passengers in the roadway before and after parking physically restricts other vehicular movements, particularly in the lane adjacent to the on-street parking. When located too close to an intersection on-street parking may also reduce intersection sight distance.

Effective parking management can help balance mobility and safety with parking demand. The following parking management strategies should be considered for the Bend MPO:

- Allow or prohibit on-street parking based on functional classification.
- In core urban areas develop parking zoning as appropriate: short-term, long-term, no parking, no stopping or standing, loading, taxi, bus, permits, and public agency.
- Establish a minimum distance from intersections for no-parking zones based on functional classification and traffic control (e.g. stop control vs. traffic signal).
- Prohibit on-street parking adjacent to bicycle lanes where possible to reduce conflicts. Use parking bays or other designs from the *Oregon Bicycle and Pedestrian Plan* when both bicycle lanes and on-street parking need to be accommodated.
- Establish off-street parking requirements for private developments.
- Provide incentives for shared parking at commercial and retail developments.
- Establish thresholds for constructing public agency managed off-street parking facilities.
- Adhere to adopted access management standards for the location and design of approaches to off-street parking facilities.

Parking may also be managed using the following transportation demand management strategies, which are aimed at altering travel behavior by reducing the demand on the roadway network particularly during peak periods:

- Reduce the availability of long-term parking in downtown and other core urban areas.

⁵ *Traffic Engineering Handbook*, 5th ed. Institute of Transportation Engineers, 1999.

- Develop pricing strategies that charge the true cost of parking or that vary by time of day (e.g. higher prices during peak periods).
- Develop parking fines that discourage violation of parking time limits.
- Expand parking enforcement activities.
- Provide incentives for constructing park and ride facilities outside the core urban area for use with employer ride-share programs or a public transportation system.

The *Deschutes County ITS Plan Update* includes a Long-term timeframe project for a downtown Bend parking management system (DC-TM-06) that monitors occupancy in the parking garage, alerts travelers if the garage is full, and provides guidance to alternate available parking.

Traffic Signal Management and Operations

Approximately 60 traffic signals are used to control vehicular and pedestrian traffic in the Bend MPO and as many as 10 may be installed during the next 20 years. Traffic signals are primarily used to control the movement of traffic in an orderly manner at intersections with high volumes of vehicular traffic. They may also be used at locations with high pedestrian volumes, at school crossings, or at locations with crash histories that may benefit from a traffic signal. The management and operation of traffic signals greatly impacts the efficiency of the transportation network. It is estimated that poor signal timing accounts for five to ten percent of all traffic delay, but the good news is that traffic signal timing optimization projects typically have a 40:1 benefit-to-cost ratio⁶. Coordinated signal timing projects in Oregon have yielded the following benefits:

- 10- to 40-percent reduction in stops
- 15- to 45-percent reduction in delay
- 5- to 25-percent reduction in travel time
- Up to 15-percent increase in corridor travel speeds
- Up to 15-percent reduction in fuel consumption

To optimize system efficiency the Bend MPO should implement the following traffic signal management and operations strategies:

- Remove unnecessary traffic signals. Changes in land use, reduced travel demand, or geometric improvements may eliminate the need for a traffic signal that was once warranted. An engineering study should be conducted based on *MUTCD*⁷ guidelines to determine whether a traffic signal should be removed and the appropriate traffic control that should be used in its place.
- Install new traffic signals when warranted. Intersections should be evaluated using the *MUTCD* traffic signal warrants to determine if and when new traffic signals should be installed. Most often new traffic signals will be warranted due to changes in land use that result in increased travel demand.
- Utilize traffic signal hardware and software that support desired functionality.

⁶ *National Traffic Signal Report Card, Executive Summary*. National Transportation Operations Coalition, 2012.

⁷ *Manual on Uniform Traffic Control Devices, 2009 Edition*. U.S. Department of Transportation, Federal Highway Administration, 2009.

Advances in technology in the past few years have led to the availability of traffic signal hardware and software with more options available than ever before. The *Deschutes County ITS Plan Update* identified the following key features of a traffic signal system that will help optimize traffic signal operations in the Bend MPO: remote control and monitoring capability, controller error processing, and report generation. The recent completion of the Central Signal System Project in Bend addressed these key features.

- Implement traffic signal preemption/priority. “Preemption” causes a traffic signal to switch from normal operations to a special mode to allow passage of a vehicle class (e.g. emergency vehicles, trains) and “priority” is the preferential treatment of a vehicle class (e.g. transit) by a traffic signal that may occur if it does not disrupt normal operations. Preemption is currently used at the majority of the traffic signals in the Bend MPO for emergency vehicles (except police) but there is room for enhancements. Preemption techniques should be used in the Bend MPO to enhance emergency vehicle operations and priority techniques should be used to enhance transit operations.
- Implement coordinated signal timing where applicable. Various signal timing methods are available for optimizing the operations of closely spaced traffic signals. Traditional time-of-day coordination uses pre-set timing plans that are activated at certain times of the day (e.g. AM peak, midday, PM peak). Traffic responsive coordination uses real-time traffic volumes to select pre-set timing plans based on volume thresholds. Traffic adaptive coordination uses advanced signal controller technology to adjust signal timings in real-time based on real-time traffic volumes. Although traffic responsive and adaptive coordination are relatively new, all methods strive to provide continuous green time to heavy volumes on the mainline while also serving side street traffic in a timely manner.
- Periodically update signal timing. National guidelines recommend updating traffic signal timing regularly to accommodate growth and traffic pattern changes⁸. This includes updating timings for both coordinated and isolated traffic signals.
- Investigate the use of automated stop enforcement. Technology is available to detect when vehicles run a red light, to document this violation using cameras, and to automatically issue a ticket to offenders. The Bend MPO should evaluate the effectiveness of automated stop enforcement in other metropolitan areas in Oregon (e.g. Beaverton, Medford) and determine its applicability to Bend. The use of automated stop enforcement in Bend would require the adoption of supporting legislation.

The *Deschutes County ITS Plan Update* includes the following projects that support traffic signal management and operations (see Table 9.1 for more details):

- Preemption/priority for emergency vehicles, transit, and roundabouts (Projects DC-EM-01B and DC-EM-09)
- Advanced signal timing improvements on Hwy 97 Business (3rd), Hwy 20, Greenwood, Newport, 27th, Empire, Knott, and Reed Market (Projects DC-TM-02A, DC-TM-02B, DC-TM-07A, DC-TM-07C, DC-TM-13B, and DC-TM-17A, DC-TM-17B)

⁸ *National Traffic Signal Report Card, Executive Summary*. National Transportation Operations Coalition, 2012.

Additional projects or programs may be needed to review warrants for removing or installing traffic signals and for performing periodic traffic signal timing updates.

Speed Management

Uniform travel speeds consistent with a roadway's design provide for the safest and most efficient transportation system operation. Posted speeds are used to supply guidance to drivers in unfamiliar locations, discourage unreasonable driving behavior, and provide law enforcement with a means to identify excessive speeds. In 2012 travel speeds too fast for roadway conditions contributed to approximately 12 percent of all crashes in the Bend area and were also a contributing factor in one of the area's three fatalities⁹. Speeding traffic can also erode the livability of neighborhood streets. The following speed management strategies should be considered for use in the Bend MPO to reduce speed-related crashes:

- Driver Feedback Speed Signs: Driver feedback speed signs provide drivers with the speed limit (static information) and the driver's actual speed (real-time information) based on radar detection or other measurement methods. These signs have proven effective in reducing speeds because often drivers are not aware they are speeding until they see their actual speed. Driver feedback speed signs can be installed permanently or can be moved around on a temporary basis using trailers.
- Variable Speed Limit Systems: Variable speed limit systems use sensors to monitor real-time traffic conditions (e.g. prevailing travel speeds and volumes) and/or weather conditions and post appropriate enforceable speeds on dynamic message signs. Speeds may also be set manually based on other factors such as work zone activity. ODOT has successfully been using variable speed limit signs throughout Oregon to reduce travel speeds in work zones during lane restrictions and working hours.
- Automated Speed Enforcement: Technology is available to detect vehicles traveling faster than the posted speed and to automatically issue a ticket to offenders. The Bend MPO should evaluate the effectiveness of automated speed enforcement in other areas of Oregon and determine its applicability to Bend. The use of automated speed enforcement in Bend would require the adoption of supporting legislation.
- Traffic Calming: Numerous traffic calming techniques are available and have proven effective in reducing travel speeds and cut-through traffic on collectors and local roadways. Techniques include speed humps, traffic circles, traffic barriers, narrowed travel lanes/roadway cross-sections, wider sidewalks, curb extensions, pedestrian refuge islands, planted medians, turn restrictions, or a combination of these techniques. Area wide traffic calming treatments are often needed to ensure traffic problems on one roadway are not shifted to an adjacent roadway. The use of traffic calming elements in the design of new roadways can minimize the need for future enhancements.

⁹ 2012 Oregon Traffic Crash Summary. Oregon Department of Transportation, Transportation Data Section, Crash Analysis and Reporting Unit, September 2013.

The *Deschutes County ITS Plan Update* includes speed management strategies within three of the projects. The Speed Photo Enforcement project (DC-TM-42) incorporates speed photo enforcement on Mt Washington Drive, Empire Avenue, and Brookwood Boulevard, and the Century Drive Safety and Efficiency Improvements project (DC-TM-09) includes both variable speed limit signs and speed photo enforcement on Century Drive and the Portable Work Zone Equipment project (DC-MC-04) includes the use of variable speed limit signs in work zones.

Geometric Improvements

Often geometric improvements can be a cost-effective means of improving the safety and efficiency of the existing transportation system. Changing traffic conditions and piecemeal development often impact the operation of existing roadways and intersections. The Bend MPO should consider the use of the following strategies for improving geometric design based on site specific engineering evaluations:

- Realign roadways to enhance sight distance and reduce skew at intersections.
- Trim vegetation to enhance sight distance.
- Provide channelization for left turn movements, right turn movements, and bus movements. Channelization may be provided using striping, medians, islands, and pullouts.
- Consider lane use restrictions during peak periods. For example, the prohibition of left turns when suitable alternate routes are available may improve safety and reduce travel delay at some intersections.
- Re-stripe travel lane widths.
- Add or enhance destination signing at activity centers and intersections.
- Improve or remove modal crossings (e.g. at-grade rail crossings).

Geometric improvements are included in a number of projects in the Motor Vehicles chapter and the *Deschutes County ITS Plan Update* includes four advanced rail warning system project (DC-TM-19A, DC-TM-19B, DC-TM-19C, and DC-TM-19D) to deploy railroad crossing train detection and warning systems.

Value Engineering and Systems Engineering

Both value engineering and systems engineering are methodical processes used during project development and design to ensure the final product effectively meets user needs in a cost-efficient means. Value engineering is "the systematic application of recognized techniques by a multi-disciplined team which identifies the function of a product or service; establishes a worth for that function; generates alternatives through the use of creative thinking; and provides the needed functions, reliably, at the lowest overall cost."¹⁰ The FHWA requires a value engineering assessment on all federal-aid transportation projects with a cost greater than \$25 million and have found that value engineering provided a return on investment ranging from 80:1 to 146:1 for fiscal years

¹⁰ *Value Engineering*. U.S. Department of Transportation, Federal Highway Administration. <http://www.fhwa.dot.gov/ve/>. Accessed July 3, 2014.

2009 through 2012¹¹. Systems engineering is an offshoot of value engineering that focuses on projects that include technology. The FHWA requires a systems engineering analysis commensurate with the project scope for all ITS projects that use federal funds. Research has shown that projects that utilize systems engineering improve overall project cost performance (actual cost versus planned cost) whereas the actual costs on projects that do not use a systems engineering approach are 50 percent over planned costs on average¹¹.

The following strategies should be used for efficient and cost-effective transportation project delivery in the Bend MPO:

- Use value engineering or systems engineering per FHWA guidelines on all federal-aid projects.
- Develop thresholds (e.g. overall project cost) and criteria for determining when to use a full value engineering or systems engineering approach on a project.
- Develop scaled-back value engineering and systems engineering approaches for smaller projects.
- Utilize the “ITS Systems Engineering and Architecture Compliance Checklist” that ODOT developed for use on ITS projects deployed in Oregon.

Asset Management

“Asset management is a systematic process of maintaining, upgrading, and operating physical assets cost-effectively. It combines engineering principles with sound business practices and economic theory, and it provides tools to facilitate a more organized, logical approach to decision-making.”¹² Although not a new concept, asset management has become increasingly important because today’s transportation system is characterized by a combination of aging infrastructure and new technologies, high system user demand, tight budgets, limited agency resources, and public accountability. The Bend MPO should utilize the following asset management strategies to maximize the functionality and prolong the life of the MPO’s assets:

- Perform preventative maintenance to prolong the life of existing infrastructure.
- Use life-cycle cost analysis to determine the useful life span of infrastructure based on all associated costs (initial, operations, maintenance) and salvage values.
- Utilize tools used at the state and federal level such as FHWA’s Highway Economic Requirements System (HERS) software.
- Develop asset management programs for major infrastructure such as pavement, bridges, traffic signals, and ITS field devices.

Many of the projects included in the Deschutes County ITS Plan Update include aspects that help improve asset management such as remote monitoring and surveillance capabilities and automated systems (e.g. roadway treatment in winter, speed

¹¹ Eric Honour, “Understanding the Value of Systems Engineering”, 2004.

¹² *Asset Management: Advancing the State of the Art into the 21st Century Through Public-Private Dialogue*. Federal Highway Administration and the American Association of State Highway and Transportation Officials, 1996.

enforcement). The following *Deschutes County ITS Plan Update* projects focus specifically on asset management:

- Maintenance Vehicle Tracking (DC-MC-05)
- Automated Maintenance Logging System (DC-MC-06)
- AVL/CAD Transit Management System (DC-PTM-01)

Chapter 10: Transportation Demand Management

Introduction & Overview

Transportation Demand Management (TDM) strategies focus on altering traveler mode choice to lower the demand on the street system, especially during peak travel times, while encouraging a variety of mobility options.

Common measures to reduce the number or alter the timing of peak hour vehicle trips include: compressed or flexible work schedules, ridesharing, use of transit, bicycle or pedestrian commuting, parking management, mixed-use development, or actions that reduce the need to travel, such as working at home/telecommuting.

TDM programs complement other transportation planning strategies and goals that are aimed at preserving livability and reducing single occupant vehicle travel. Successful programs can be measured by an increase in vehicle occupancy rates and reduced vehicle miles traveled.

Demand management strategies often involve an education and promotion effort to encourage changes from single-occupant driving behavior. Local government and other groups can help to educate the public regarding the actual costs of travel on the transportation system and encourage TDM programs to reduce system demand. Community-wide events can also encourage employees to participate in TDM efforts by promoting alternatives to driving alone. Together, these efforts can make important strides toward improving public awareness regarding travel alternatives.

Demand management programs work best where there are heavily congested corridors, clear work trip travel patterns, limited parking, and/or the provision of viable alternatives to driving. Experience from successful demand management programs indicates that other important factors include development of quantifiable goals and periodic evaluation, demand management coordination, industry involvement, parking management, employee and employer incentive programs, and strong public support. Thus, transportation demand management strategies require a concerted community effort and commitment in order to fulfill the greatest trip reduction potential.

Broader mobility needs can also be addressed through TDM measures. Bend currently has unmet mobility needs for people who live in areas where significant gaps in the multimodal transportation system exist and for people who are unable or prefer not to drive (due to age, lack of a drivers' license, etc.). The BMPO area would benefit from a balanced transportation system by enhancing the mobility of these people by improving their opportunities to move to and from work, conduct personal business around town or participate in community activities independently. The TDM measures discussed in this chapter are a good first step. TDM and enhancements to the multimodal transportation system can reduce automobile demand.

Policies

The region has specific goals and policies outlined within the local transportation plans that are specifically related to TDM. The following policies are applicable to the Bend Metropolitan planning area.

1. Encourage businesses to participate in transportation demand management efforts through the development of incentives and/or disincentives. These programs shall be designed to reduce peak hour traffic volumes by encouraging ridesharing, cycling, walking, telecommuting, alternative/flexible work schedules and transit use;
2. Work with member governments, business groups, large employers and school districts to develop and implement transportation demand management programs;
3. Continue to support the work of non-profit agencies working towards the same TDM goals as the BMPO;
4. Encourage programs such as van or carpooling (rideshare) to increase vehicle occupancy and reduce unnecessary single-occupant vehicle travel;
5. Encourage the development of park and ride facilities and consider the siting of a rideshare facility, based on identified needs, when rebuilding or constructing new roadways;
6. Encourage the development and utilization of telecommunication technologies that facilitate the movement of information and data;
7. Support efforts to educate the public regarding the actual costs related to travel on the transportation system and encourage transportation demand management alternatives;
8. Encourage the city of Bend to manage parking by:
 - Establishing programs to lower parking demand in commercial and business districts citywide by providing preferential parking for carpoolers, encouraging public transportation use, encouraging shuttle systems from external parking lots, and maintaining an adequate supply of strategically placed bike parking facilities.
 - Encouraging business groups and employers to develop parking management strategies that support reduced roadway system demand during the peak travel times.
9. Participate in Commute Options programs by assisting in:
 - Planning for park and ride facilities; and
 - Establishment of educational programs particularly those that will inform the public regarding the full costs of single occupant vehicle travel.
10. Encourage development and implementation of a strategy for ensuring full compliance to bicycle ordinances and the Bicycle Parking guidelines.
11. Encourage implementation of TDM measures before or in conjunction with street widening and construction projects.
12. Encourage a continuation of the Bend Downtowners efforts to reduce employee trips and develop parking guidelines to promote TDM strategies.
13. Plan for development and promotion of area Park and Ride lots.
14. Encourage removal of bicycle and pedestrian barriers (e.g. cinder and snow removal from road shoulders and sidewalks, installation of sidewalk intersection ramps).
15. Encourage the Parks and Recreation District to implement the planned trail system.
16. Encourage efforts at the Bend-La Pine Schools to reduce student and staff trips. This could be accomplished by:
 - Providing trail access to schools and safe and secure bicycle parking for students and staff
 - Developing student parking management plans
 - Encourage that new schools are sited for convenient walking and bicycling within the neighborhood and that the schools contribute to the costs for locating adjacent paths
 - Work with the school district and developers to identify school bus stops and reasonable amenities including, shelters or road enhancements to make the stops safer for children.

17. Support land development ordinances that create more bicycle and pedestrian friendly developments:
 - Encouraging a grid system of streets
 - Encouraging mixed-use developments
 - Redeveloping existing streets with pedestrian, transit and bicycle amenities
 - Separating sidewalks from roadways with appropriate landscaping
18. Support shuttle services to and from Bend
19. Support funding for sidewalks, bicycles, trails and transit by advocating for their inclusion in the city and county Capital Improvement Programs (CIP).
20. Work with member agencies and the Bicycle Pedestrian Advisory Committee to develop a prioritized list of bicycle and pedestrian projects for the Capital Improvement Programs.

Chapter 11: Truck Freight Systems

The Truck Freight Systems chapter was prepared for the original 2007 MPO MTP and was not updated during the 2014 update. Therefore, the description of facilities reflects the status as of 2007. This chapter will be updated during the next comprehensive MPO MTP update, after completion of the Bend UGB expansion.

Introduction

Truck freight systems serve a vital role in the economy of Bend's Metropolitan planning area. The majority of movement of raw and furnished goods is moved via truck; efficient truck mobility is crucial to the economic survival of the region.

Policies

The importance of freight to the local economy was highlighted by the Oregon Department of Transportation in planning documents, including: "Freight Moves the Oregon Economy" and the Oregon Highway Plan. The Oregon Highway Plan provides guidance on the standards of performance necessary for freight movements. The Plan includes key policies regarding freight movement:

- Maintain and improve the efficiency of freight movement on the state highway system and access to intermodal connections.
- Balance the needs of long distance and through freight movements and local transportation needs on highway facilities in both urban areas and rural communities.

Goals and objectives were developed for the Bend Metropolitan Transportation Plan and are included in a previous section of the report. The applicable goals and objectives related to freight mobility include:

- Provide a variety of practical and convenient means to move people and goods to, from and within the MPO area.
- Identify and support the development of local freight routes
- Support the through movement of goods and people on the state transportation system
- Implement transportation improvements that foster economic development and business vitality.

Truck freight specific policies include:

- Work with the city of Bend, ODOT, and Deschutes County to identify and implement appropriate signage for designated freight routes

- Work with the city of Bend and Deschutes County to identify and implement appropriate design standards for designated freight routes
- Work with the city of Bend and Deschutes County to identify and possibly implement freight route roadway classifications
- Work with the city of Bend, Deschutes County and ODOT to identify a designated freight route on the north and east sides of Bend to allow trucks traveling on US20 to avoid coming into the city of Bend or using Empire Avenue and 27th Street.
- Evaluate opportunities to establish other designated routes in the urban area as truck volume or noise issues change.
- Support implementation of the surface transportation recommendations developed through the Oregon Clean Air Initiative

Facilities

The designation of through truck routes help provide for the efficient movement of goods while balancing and maintaining neighborhood livability, public safety, and minimizing maintenance costs of the roadway system. ODOT¹ identifies Highway 97 (Bend Parkway) as a designated federal truck route and a state freight route. Highway 20 is designated a federal truck route through the entire study area. The following two sections of Highway 20 are designated state freight routes: 1) from the west study area limits to Empire Avenue and 2) from NE 11th Street to the east study area limits. The City of Bend's TSP identifies Highway 97 (Bend Parkway), Business 97, and Highway 20 as designated freight routes. The TSP also identifies Century Drive as a designated truck route. Both Highway 97 and Highway 20 have either a four-lane or five-lane section throughout the urban area. Generally, truck traffic in the urban area is largely confined to roadways adjacent to industrial, commercial and surface mining zoned properties. The surrounding arterial street system provides links from these state highways with the nearby businesses.

In addition to these regional freight routes, local freight routes were also developed for freight travel through the City of Bend. A Freight Advisory Committee, comprised of local freight industry representatives, developed these local and future local route designations. The benefit of these designations is related to the potential design and operations considerations on the local routes to accommodate large vehicles (e.g. turning radii and grades). The local freight routes and future local freight routes tie into the regional system and provide additional connections, primarily on arterial roadways. Regional, local and future local freight routes are shown in Figure 11-1.

Table 11-1 summarizes the available 2004 truck traffic as a percentage of average daily traffic (ADT) at several permanent ODOT automatic traffic recorder stations within the City of Bend.

¹ 1999 Oregon Highway Plan, Oregon Department of Transportation. May 1999.

Table 11-1: Existing Truck Volumes

Route	Automatic Traffic Recorder Location	2004 Average Daily Traffic	Truck ADT	Truck %
Highway 97	South of Revere Avenue	38,600	2,740	7.1
Highway 97	South of Empire Boulevard	41,300	3,550	8.6
Highway 97	0.9 miles south of Bend	22,150	1795	8.1
Highway 20	5 miles east of Bend	2,750	650	23.5

Freight Generators and Receivers

The main truck freight generators in Bend are manufacturing firms that ship their products throughout the region or cross country. A few regional trucking and delivery firms are based in the city. All of Bend's existing manufacturing and shipping areas are within 1 ½ miles of US 97 or US 20. The local arterial street system links these areas to the highways to provide efficient and direct movement of freight goods through the City of Bend and onto the state highway system.

Bend's population and role as a regional center has generated the development of large retailers-including supermarkets, vehicle sales, and restaurants—that receive all of their goods by truck. The large retailers are primarily located along US 97 and US 20. Other retailers and service providers that receive large or frequent truck deliveries are on local arterial streets that connect to state highways to prevent heavy vehicle from using neighborhoods routes.

Forecasts and Future Needs

The majority of the truck traffic through the Bend Metropolitan planning area is served by the state highway system. In the future, Highway 97 and 20, and 3rd Street (Business 97) will continue to serve as the desired through freight truck routes in the community.

Additionally, the completion of the City's arterial street system will improve the local movement of goods to commercial areas within the City and provide an efficient system of roads to ship products from Bend. Key improvements include the completion of Empire Avenue and planned improvements to Reed Market Road will particularly benefit the major industrial areas in the Bend Metropolitan planning area.

Figure 11-1

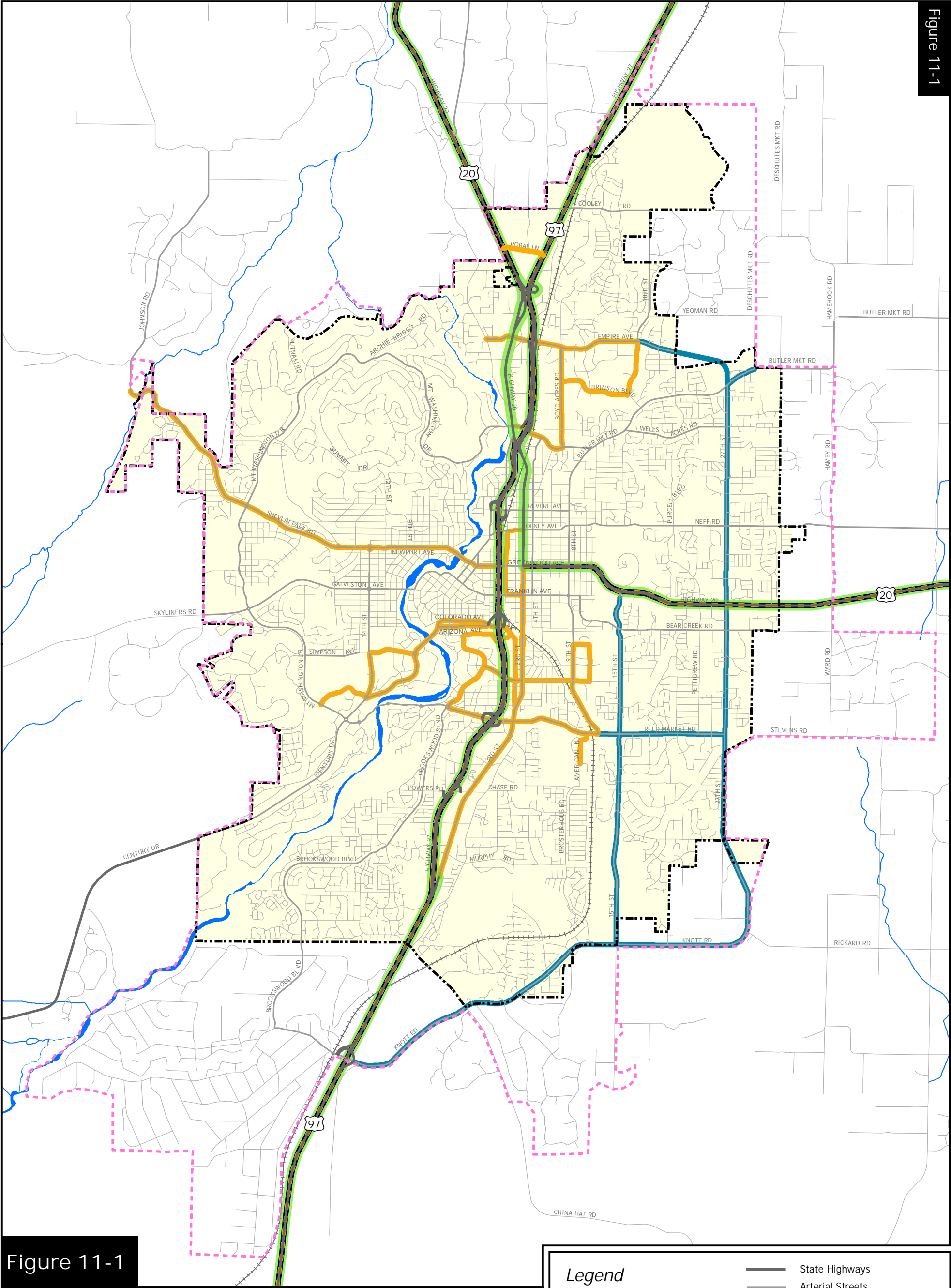
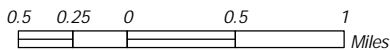


Figure 11-1

Bend MTP Truck Freight Routes

April 2007



Data sources include:
City of Bend
Deschutes County GIS
ODOT
DKS Associates

Legend

Freight Routes

- Federal Truck Routes
- State Freight Routes
- Local Freight
- Future Local Freight

- State Highways
- Arterial Streets
- Roads
- Railroad
- MPO Boundary
- Bend Urban Growth Boundary
- City Limits
- Streams
- Canals
- River

Chapter 12: Transportation Safety

Introduction

Safety can be defined as the ability of a person to use the regional transportation system (any mode) to transport themselves, passengers, or goods in a way that does not endanger themselves, others using the system, the population, or the environment. Reducing the risk of transportation-related crashes for all users of the system is an important element of the planning process and development of the Bend Metropolitan Transportation Plan.

The passage of the Safe Accountable Fair Efficient Transportation Equity Act – A Legacy for Users (SAFETEA-LU) brought increased attention to addressing the safety of the transportation system. SAFETEA-LU required regional plans to consider how to best increase the safety of the transportation system for motorized and non-motorized users. The Moving Ahead for Progress in the 21st Century Act (MAP-21) replaced SAFETEA-LU in July 2012 as the current federal transportation authorization bill. MAP-21 increases the emphasis on safety by requiring the US Department of Transportation (USDOT) to set performance measures related to fatal and severe injury crashes. It also significantly increases funding for the Highway Safety Improvement Program.

This chapter presents the transportation safety element. The purpose of this chapter is to identify programs and plans directed at improving transportation safety in the MPO region and outline strategies the MPO can undertake. As the chapter will note, there are already systematic screening programs in place for area roadways. Therefore, no new analysis of crash data was completed.

Safety Background Information

The purpose of this section is to provide background information on the regulations and policies that guide transportation safety planning and programming in the Bend MPO region.

Policy and Regulatory Framework

Several agencies at the federal and state level have developed plans and corresponding strategies that address the safety of their transportation facilities. These plans stress the importance of building, maintaining, and operating a transportation system that is safe for all users.

Federal

Congress enacted MAP-21 in 2012. Like the authorization bill before it, MAP-21 promotes safety as one of eight planning factors to be included in metropolitan planning. It also increases funding for the Highway Safety Improvement Program.

The national goal for safety set by MAP-21 is to significantly reduce fatalities and

severe injuries on public roads. To achieve that goal, the bill requires that the USDOT define relevant performance measures. Once these measures are set, States will have one year to define their respective targets, in coordination with MPOs and public transportation providers, for each measure. After the State measures are defined, MPOs will have 180 days to set their targets. These targets are to be coordinated with the State's targets and any targets set by local public transportation providers. USDOT has proposed four performance measures related to fatal and severe injury crash frequency and crash rate. These measures are not expected to become effective until the second quarter of 2015¹.

State

Transportation Planning Rule (TPR)

In 1991, the Land Conservation and Development Commission adopted the Oregon Transportation Planning Rule (TPR). The TPR implements State Land Use Planning Goal 12, Transportation, which was adopted by the Oregon Legislature in 1974. The TPR requires most cities and counties and the state's Metropolitan Planning Organizations to adopt transportation system plans that consider all modes of transportation, encourage a safe environment and avoid principal reliance on any one mode to meet transportation needs. By state law, local plans in MPO areas must coordinate with the metropolitan transportation plan (MTP). Recent updates to the TPR do not affect the requirements for safety planning.

Oregon Transportation Plan (OTP)

The Oregon Transportation Plan, amended in September 2006 by the Oregon Transportation Commission (OTC), includes Goal 5 which addresses safety and security and details related policy and strategies. The OTP safety goal and policy is outlined below. Several key strategies were also identified in the plan to help attain the desired outcome of a safe transportation system.

Goal 5 – SAFETY AND SECURITY

To plan, build, operate and maintain the transportation system so that it is safe and secure.

Policy 5.1 – Safety

It is the policy of the State of Oregon to continually improve the safety and security of all modes and transportation facilities for system users including operators, passengers, pedestrians, recipients of goods and services, and property owners.

Transportation Safety Action Plan (TSAP)

The most recent version of ODOT's Transportation Safety Action Plan was adopted in 2011. It identifies 112 actions to reduce crashes, as well as improve the outcome of crashes. These actions cover a range of strategies, including engineering, enforcement, education, emergency medical services (EMS), and evaluation related activities. Ten of

¹ <https://www.fhwa.dot.gov/tpm/about/action.pdf>

these actions are designated as Emphasis Area Actions because they address the most significant contributing factors to fatalities and severe injuries. The Emphasis Area Actions include measures related to speed, impaired driving, occupant/bicyclist protection, inexperienced drivers, and EMS. The strategies outlined in the action plan provide guidance to potential safety investments within the Bend Metropolitan planning area.

The TSAP also provides a summary of crash trends around the State and significant measures that have been implemented to reduce fatalities and severe injuries on Oregon's roads. ODOT will initiate an update to the TSAP in 2015.

BMPO Safety Goals and Policies

In addition to the goals outlined in the new federal legislation, the Bend MPO has set goals and policies that emphasize the importance of building, maintaining and operating a regional transportation system (regardless of mode) that is safe for all users. The goals and policies of the Bend MTP were developed based on a review of the existing goals outlined in other regional and local plans (e.g. Oregon Highway Plan, Deschutes County TSP, and City of Bend TSP) and are outlined in Chapter 2. The goals related to safety were created and adopted to help guide the future development of the roadway network, address safety concerns in a range of areas, and select specific projects for construction. Stemming from the goals and policies, a series of evaluation criteria have been developed to rank potential projects for the regional transportation system. Evaluation criteria includes: the ability of a project to address existing safety deficiencies and the ability to support TSM/ITS strategies.

Safety Planning in the Bend MPO

The Oregon Department of Transportation (ODOT) and the City of Bend have existing processes for performing detailed network screening and plans that include specific safety-related recommendations in the Bend MPO region.

ODOT Safety Implementation Plans

ODOT has completed plans that contain specific implementation strategies for three different safety emphasis areas: intersection, roadway departure, and pedestrian and bicycle crashes.

Roadway Departure Safety Implementation Plan

This plan's goal is to reduce fatalities from roadway departure crashes statewide by 20 percent. It describes a number of countermeasures that could be deployed systematically to achieve this goal and it advocates for a multidisciplinary approach involving coordinated engineering, enforcement, and education efforts. Appendix B of the plan identifies State and local roads, including several locations in the Bend MPO, that could benefit from deployment of specific countermeasures.

Intersection Safety Implementation Plan

Oregon's Intersection Safety Implementation Plan predicts that statewide intersection fatalities will be reduced by about thirteen percent if its recommendations are fully implemented. Similar to the plan for roadway departures, this plan details countermeasures to be deployed systematically in conjunction with a coordinated engineering, education, and enforcement approach. Specific intersections identified within the Bend MPO region for potential countermeasure deployment can be found on the plan's website: <http://www.oregon.gov/ODOT/HWY/TRAFFIC-ROADWAY/Pages/intersections.aspx>.

Pedestrian and Bicycle Safety Implementation Plan

This mode-specific plan uses a systemic planning process to identify priority corridors across all public roads in the state. These corridors are where treatments are likely to have the most impact for reducing the severity and/or frequency of crashes involving people walking or bicycling. The plan also contains a toolbox of countermeasures and outlines a project development framework that could help future projects in the Bend MPO.

Project candidate locations are identified for each region based on either a risk-based or crash-frequency-based assessment for each mode. Identified corridors within the Bend MPO can be found in Part A of the plan.

ODOT Safety Priority Index System

ODOT maintains a Safety Priority Index System (SPIS) that ranks high collision locations statewide in order to identify sites for further investigation. SPIS fulfills screening requirements for the Highway Safety Improvement Program (HSIP) authorized in MAP-21. The process was recently updated in 2012 to include not only state facilities, but also most local arterial and collector roads (those for which volume data is readily available). The system provides a weighted score based on the severity, frequency, and rate of collisions over the previous three years. Each year, sites that are in the top 5% in terms of their SPIS ranking are investigated further to determine if there is a systematic issue(s) that can be addressed. Potential treatments undergo a benefit-cost analysis and promising projects are initiated using HSIP or other funds. States used to be required to file a report on their top 5% locations, but MAP-21 removed this requirement. A map of the top 15% SPIS sites can be found on ODOT's website:

http://www.oregon.gov/ODOT/TD/TDATA/pages/gis/odotmaps.aspx#spis_sip_maps.

More information on the SPIS sites identified within the Bend MPO region can be requested from ODOT.

All Roads Transportation Safety

In 2012, ODOT completed a Memorandum of Understanding (MOU) with the League of Oregon Cities and Association of Oregon Counties that describes how HSIP funds will be allocated to roads managed by local jurisdictions in Oregon. This program is known as the All Roads Transportation Safety (ARTS) Program (formerly known as Jurisdictionally Blind Safety Program). The purpose of this program is to collaboratively

reduce fatal and serious injury crashes on all public roads across the state through data-driven processes that are jurisdictionally blind. There is currently a transition plan in place for beginning the ARTS program, with full implementation expected by 2017.

City of Bend Multimodal Traffic Safety Program

The City of Bend recently established a comprehensive data-driven roadway safety management program. This program generally follows the principles outlined in the *Highway Safety Manual* and involves network screening; diagnosing crash causes, types, and other characteristics; and determining how to most cost-effectively reduce crashes. The process has been carried out once so far and is expected to be refined and repeated in coming years.

The current program covers the years 2012-14. Its screening process identified 21 priority locations for more detailed investigation. Further review of these sites identified crash trends that could potentially be addressed by a countermeasure at 19 of the 21 sites. The estimated cost of implementing the identified treatments is just over \$2 million, while the expected economic benefits from reduced crashes is expected to be over \$10 million, a fivefold return. It also identifies education and enforcement strategies aimed at the following behaviors, identified as priorities during the screening phase:

- Driving under the influence of intoxicants (DUI)
- Speeding
- Red light running
- Bicycle and pedestrian nighttime visibility (i.e. clothing, reflectors/lights)
- Wrong-way bicycle riding

Bend MPO State of Safety Report

The Bend MPO is working on a report describing the state of safety within the MPO boundaries. When completed, this document will describe existing crash data, including patterns and trends, identify safety goals for the region, and outline strategies to be undertaken to achieve those goals. The MPO plans to extend elements of the City's Multimodal Traffic Safety Program into the unincorporated areas of the MPO as part of this plan.

Planned Safety Projects in the Bend MPO

The screening processes described above have produced candidate projects that have been prioritized and selected for implementation. Table 12-1 summarizes these projects according to the process that identified them (i.e. ODOT HSIP or City of Bend Multimodal Traffic Safety Program). When constructed, these projects will represent nearly \$4 million in overall investment in reducing crashes in the Bend MPO area. Note that the ODOT HSIP identifies projects falling into one of three categories:

- Signalized/FYA – Signalized intersection improvements, including flashing yellow arrow (FYA) upgrades where applicable
- Pedestrian – Improvements targeting reduced pedestrian crashes at signalized intersections

- Curve Signage – Improving curve signage and pavement markings

Table 12-1: Planned Safety-Specific Projects in Bend MPO

Location	Description	Estimated Cost
ODOT HSIP Projects		
Reed Market Road: 3 rd St – 27 th Ave	Signalized/FYA	\$52,000
Knott Road/27 th Street:	Curve Signage	\$32,500
US 97 – Stevens Rd		
3 rd Street: Revere Ave – Murphy Rd	Signalized/FYA	\$156,000
27 th Avenue: Butler Market Rd – Bear Creek Rd	Signalized/FYA	\$130,000
Penn Ave/Neff Rd – 8 th St – Medical Center	Signalized/FYA	\$78,000
Wall St/Bond St – Newport Ave – Idaho Ave	Pedestrian	\$39,000
Wall St/Bond St – Revere Ave – Franklin Ave	Signalized/FYA	\$273,000
<i>ODOT HSIP Total</i>		<i>\$760,500</i>
City of Bend Multimodal Traffic Safety Program Projects		
Bear Creek/Purcell/Pettigrew	Stop Sign Visibility	\$6,820
Country Club/Murphy Powers/3 rd	Stop Sign Visibility	\$5,390
	Signal Modifications, Pedestrian Crossing Improvements	\$65,586
Reed Market Rd/3 rd	Signal Modifications, Pedestrian and Bike Crossing Improvements	\$208,287
Reed Market/27 th	Signal Modifications	\$96,740
Wilson/2 nd	Do Not Block Intersection	\$18,480
	Signing and Markings	
Butler/27 th	Signal Modifications, Bike Lane	\$56,570
Division/Revere	Signal Modifications, Road Diet	\$347,687
Bond/Colorado	Signal Modifications	\$55,300
Awbrey/Portland	Mini Roundabout	\$98,883
Brosterhous/3 rd	Signal Modifications	\$69,000
Neff/Purcell	Signal Modifications, Bike Lanes	\$86,590
Franklin/Wall	Signal Modifications, Pedestrian Crossing Improvements, Eliminate Right-turn Lane/Add Parking Spaces	\$56,506
Greenwood/1 st	Road Diet	\$273,867
Greenwood/Hill	Road Diet	\$273,868
3 rd /Franklin	Signal Modifications, Bike Crossing Improvements	\$208,207

Location	Description	Estimated Cost
Greenwood/Hill	Shared Lane Markings	\$49,166
1 st /Franklin	Road Diet, Bike Crossing Improvements	\$207,531
<i>City of Bend Total</i>		<i>\$3,118,321</i>
Overall Total		\$3,878,821

Safety Programs in the Bend MPO

In addition to the plans described above, there are a number of ongoing transportation safety-focused programs in the Bend MPO region. Key programs are described below.

Road User Safety Task Force

Initially formed to improve road safety for people on bicycles, the road user safety task force now focuses on reducing crashes between motor vehicles and bicycles and pedestrians. Many of the task force's efforts are aimed at educating road users. Notable projects the group has taken on include media campaigns, obtaining a proclamation from the Bend City Council of a road safety week in each year starting in 2010, and a bicycle and pedestrian counting program.

Traffic Safety Advisory Committee

The City of Bend's Traffic Safety Advisory Committee is both an interagency and citizen group made up of representatives from the City's Fire & Rescue, Police, and Community Development departments and Transportation Division, ODOT Region 4, Bend/LaPine School District, Deschutes County Road Department, and five citizens-at-large. This committee is responsible for overseeing safety-related projects and programs in Bend and ensuring interagency/departments coordination. It also provides a forum for public comment on transportation safety matters, advises other committees (including the Bend MPO board), liaises with the Oregon Traffic Safety Commission, and promotes awareness of safety programs and issues.

Bicycle Diversion Program

The mission of the bicycle diversion program is "education through enforcement." Under this program, people who are cited for bicycle-related traffic infractions are given the option to have their fine reduced by taking an educational course that is offered monthly. The program is a collaborative effort of local enforcement agencies, the City of Bend, and Commute Options.

Pedestrian Injury Prevention Action Team Program

Commute Options was recently selected to participate in the *Pedestrian Injury Prevention Action Team Program* run by the Safe States Alliance. As a part of this program, Commute Options staff will receive guidance in preparing training materials for local and State agencies and conduct these trainings and have the access to grant

funds that can be awarded to local agencies.

Shared Future Coalition

The Shared Future Coalition is a Deschutes County group formed to reduce underage and binge drinking in 18 to 25 year olds. ODOT and the City of Bend have representative members in this group. The group is focused on community engagement to educate and reduce environmental influences.

Safety Strategies for Bend MPO

The plans described above contain a number of strategies related to engineering, education, enforcement, and policy development to reduce crashes in the Bend MPO region. There are several opportunities for safety-related policy development within the Bend Metropolitan planning area. These opportunities include:

- Supporting the City of Bend and ODOT with implementing the projects and programs identified in their safety plans, including support in the development of application materials for the new All Roads Transportation Safety (ARTS) program.
- Working with the City of Bend, Deschutes County, and ODOT to coordinate network screening and safety planning efforts within the MPO region, including expanding the City's screening methods to the unincorporated areas in the MPO region.
- Continuing Intelligent Transportation Systems planning and project programming, paying special attention to investments that will enhance safety.
- Continue refining safety criteria for project scoring, selection, and implementation.
- Identifying additional transportation funding sources that are specifically targeted at safety projects to supplement the limited funds from conventional transportation sources.
- Continuing to stay abreast of research on transportation safety developed by national and regional agencies around the country, seeking out best practices that can be applied within the Bend Metropolitan planning area.

A number of projects have been identified and included in the Preferred Alternative Project List in Chapter 6 of this plan that address the underlying safety issues of critical locations within the Bend Metropolitan Planning Area. The purpose of these projects is to reduce the potential for collisions, using a variety of countermeasures. With limited resources, focusing improvements on corridors has emerged as a way to manage the existing roadway system. Corridors are the focus of traffic safety projects that typically initiate a combination of roadway improvements, enforcement efforts, and public

information and education programs. Corridor analysis can also be useful to examine trends in crashes over multiple years and to track whether or not improvements on a corridor contributed to a reduction in crashes.

Ensuring the Bend Metropolitan planning area has a transportation system that is safe to use is a complex task. Several strategies for implementation have been recommended that could potentially improve the safety for all modes of travel; however, additional data and analysis are required to better inform the decision making process where limited funds would provide the most return on investment. Future updates to the Plan may include additional data on where incidents have occurred and how successful the proposed solutions have been in addressing the underlying issues.

Chapter 13: Security

Introduction

Security is one of the planning factors that must be considered in the metropolitan transportation planning. The importance of security in the planning process has gained prominence in recent years. Several national and regional research efforts have been created to address the transportation security issue in more depth, but MPO work in this area is still limited.

This chapter is a first step by the BMPO to address transportation security in more depth in the Bend area. It covers the following:

- The context for transportation security;
- A discussion of the potential role of the BMPO in transportation security planning;
- Bend area modal security data, where available; and
- Recommendations for further BMPO security work.

The chapter addresses security across all modes of transportation.

National Background

Security and the Metropolitan Transportation Planning Process

Safety and security are closely related, although distinct, aspects of all transportation modes. The ideal situation is that all elements of the multi-modal transportation system are both safe and secure. That, however, is not always the case and plans must be made for prevention and readiness to address possible security issues.

A recent study summarizes the evolving awareness: “Prior to September 11th...security issues were not an issue in most state and MPO surface transportation planning processes. Transportation Improvement Programs...did not contain allocations for security related issues. Agencies are now faced with determining how security concerns should be integrated into how we plan, design, implement and operate transportation facilities and services. Is security simply another goal for our transportation system that can be integrated into our planning similarly to how we accommodate safety concerns today, or does addressing security require more radical changes including such actions as redefining organizational structures, modifying basic planning processes and developing or refining planning methods, models and tools?”

It concludes: “Over the next several years, security considerations will result in changes in how transportation is planned, designed, implemented and operated. Transportation goals, planning processes, databases, analytical tools, decision-making considerations, and organizational structures will change due to security concerns. Transportation will be on the front line in responding to security risks. The response to security concerns

will cross jurisdictional and functional lines and be among the most complex and important challenges to transportation professionals. While it may be too early to begin changing our long-range infrastructure network plans in response to security risks, there will be changes in spending priorities in the near term and most probably over a longer period of time “

Definitions

The simplest distinction between safety and security is that safety problems, typically vehicle crashes, are unpremeditated events. As such, they may be caused driver error or impairment, adverse weather, a temporary hazard in the right-of-way, poor infrastructure or vehicle design. By contrast, security events always connote a negative intention, whether committed by an individual or a group. In number, attacks on transportation systems are few, with the vast majority of security breaches being committed by non-political individuals. But attacks, when they do occur, can be much more dramatic, harm many people, and require much more effort to address. Figure 13-1 provides a description of various types of security problems that can arise in transportation systems.

Figure 13-1 Types of Transportation Security Problems

Event	Description
Aggravated Assault	An unlawful attack by 1 person upon another for the purpose of inflicting severe or aggravated bodily injury. This type of assault usually is accompanied by the use of a weapon or by means likely to produce death or great bodily harm.
Arson	To unlawfully and intentionally damage, or attempt to damage, any real or personal property by fire or incendiary device.
Burglary	The unlawful entry of a structure to commit a felony or a theft. This includes offenses known locally as burglary, unlawful entry with intent to commit a larceny or felony, breaking and entering with intent to commit a larceny and all attempts at these offenses.
Larceny/Theft	The unlawful taking, carrying, leading or riding away of property from the possession or constructive possession of another. This includes pocket picking, purse snatching, thefts from motor vehicles, thefts of motor vehicle parts and accessories, theft of bicycles, theft from buildings, theft from coin operated devices or machines, and all other theft not specifically classified.
Trespass	To unlawfully enter land, a dwelling or other real property.
Vandalism	The willful or malicious destruction, injury, disfigurement or defacement of any public or private property, real or personal, without consent of the owner or person having custody or control by cutting, tearing, breaking, marking, painting, drawing, covering with filth, or any other such means as may be specified by local law.
Terrorism	The willful or malicious destruction, injury, disfigurement or defacement of any public or private property by domestic or foreign nationals for the purpose of making a political impact.

Source: Adapted from *National Transit Database*

Creation of the Department of Homeland Security

The Department of Homeland Security (DHS) was created in 2003. The DHS inherited the professional workforce, programs and infrastructure of the Coast Guard, Customs Service, Immigration and Naturalization Service, and the Transportation Security Administration among others. Collectively, these public servants are responsible for protecting the nation's transportation systems and supervising the entry of people and goods into the United States. This is no easy task given that 730 million people travel on commercial aircraft each year. Additionally, 11.2 million trucks and 2.2 million rail cars cross into the U.S. each year. Also, 7,500 foreign flagships make 51,000 calls in U.S. ports annually.

The DHS is responsible for protecting the movement of international trade across US borders, maximizing the security of the international supply chain, and for engaging foreign governments and trading partners in programs designed to identify and eliminate security threats before these arrive at U.S. ports and borders.

Intelligent Transportation Systems

In the past decade, federal transportation programs have been developed that focus on information technology to address various problems. These programs, collectively known as Intelligent Transportation Systems (ITS), can make a major contribution toward transportation security.¹ ITS projects can assist in all phases of security.

Key National Issues

Aviation

In recent years, many restrictions came into place on both commercial and general aviation. One of the most significant changes was upgraded passenger screening at all commercial airports. Other changes include implementation of new security technologies at the nation's airports². Many other upgrades are still being developed and will be implemented in the coming years.

Highways

One of the DHS's goals is ensuring that the security of drivers and cargo on the highway system are not compromised. Officials with the Federal Motor Carrier Safety Administration (FMCSA) are charged with reviewing security measures with motor carriers and shippers that may be the target of terrorist attack. Its mission is to increase the level of awareness of hazardous materials carriers to terrorist threats. FMCSA field staff will be providing information in the form of recommendations and suggestions, except those regulatory requirements affecting the actual movement of hazardous materials. Highlights of the Security Talking Points are outlined below. These recommendations may not apply to all carriers, based on their size and scope of operation. Additionally, this list is not all-inclusive and will be changed based on future priorities to address potential threats.

¹ It is also true that because of ITS installations dependence on computers and electrical power, these systems are also more vulnerable to security threats than are many other transportation elements.

² See <http://www.tsa.gov/public/display?theme=44&content=09000519800ac831>

FMCSA will recommend to carriers that a security plan be developed and implemented. These plans should include:

- Personnel Security
- Hazardous Materials and Package Control
- En Route Security
- Technical Innovations
- Management Prerogatives
- Communications
- Reassessment Based Upon Current Conditions

FMCSA also recommends that management encourage input and participation in the development and implementation of these security programs. For more information, visit the Federal Motor Carrier Safety Administration website (<http://www.fmcsa.dot.gov>).

Transit

By law, up to one (1) percent of urbanized funds / formula funds for transit may be used for safety and security. To date, much of the focus has been on Greyhound and other intercity bus systems. Security grants are being used to enhance security for intercity bus operations by focusing on driver protections; improved monitoring and communications with over-the-road buses; implementing and operating passenger and baggage screening programs; assessing critical security needs and vulnerabilities; and training transportation personnel to recognize and respond to criminal attacks and other potential threats, as well as in improving evacuation procedures.

The security threat to bus operations, however, is not limited to intercity services. A report prepared in 2001 discusses the fact that transit-related attacks are nothing new: "Contemporary terrorists have made public transportation a new theater of operations...an individual or a group calling itself "Sons of the Gestapo" derailed a passenger train in Arizona in 1995...extremists (in 1997)..plotted suicide bombings in New York's subways."³

Most of these reports depict a level of activity that had not been encountered in the U.S. In today's global society, however, no country can consider itself immune from terrorism, while the traditional crimes of assault and vandalism must also be handled. A summation of security risks for modes using the surface transportation network is shown in Figure 13-2.

³ *Protecting Public Surface Transportation Against Terrorism and Serious Crime: An Executive Overview* by Brian Michael Jenkins, Mineta Transportation Institute (MTI Report 01-14) Jose State University, October 2001

Figure 13-2 Scenarios Considered in the U.S. DOT Vulnerability Assessment (Partial List)

Physical Attacks	
<ul style="list-style-type: none"> • Bomb at bridge approach • Series of small explosives on highway bridge • Single small explosive on highway bridge • Series of car bombs on adjacent bridges • Bomb at pipeline compressor stations • Bomb detonated at pipeline storage facility • Bomb detonated on pipeline segment 	<ul style="list-style-type: none"> • Bus bombing • Deliberate blocking of highway-rail grade crossing • Bomb detonated on train in rail station • Vandalism of track structure & signal system • Bombing of rail bridge • Explosives attack on multiple rail bridges
Chemical Attacks	
<ul style="list-style-type: none"> • Physical attack on railcar carrying toxics 	
Cyber Attacks	
<ul style="list-style-type: none"> • Cyber attack on highway traffic control system • Cyber attack on pipeline control system 	<ul style="list-style-type: none"> • Sabotage of train control system • Tampering with rail signals • Cyber attack on train control center

Source: National Research Council, *Improving Surface Transportation Security, A Research and Development Strategy*, Washington D.C: National Academy Press, 1999.

The Potential Role of the MPO in Transportation Security Planning

Despite the requirements in prior legislation to address security, most MPOs did little security planning until recent years. One writer sums up the overall safety and security environment: "Prior to September 11th most concerns were focused on how best to include safety considerations in the transportation planning process. For example, many MPOs and DOTs have fairly advanced methodologies for selecting projects to be included in the Transportation Improvement Program (TIP) or Statewide Transportation Program (STIP)...From a sample of 13 MPOs, it was not uncommon for safety concerns to represent 10 to 20 percent of the point allocation for highway projects, but little recognition was given to security issues...Also, it was found that safety and security were frequently ignored in the prioritization of transit, intermodal, or enhancement projects...One interesting issue is how security measures can be defined and quantified for project selection."⁴

Recommended Approach to Transportation Security Planning

A Transit Cooperative Research Program (TCRP) report⁵ as well as many other sources group security planning into four subject areas:

- Prevention activities;
- Preparation activities;
- Response activities; and
- Recovery activities.

⁴ *The Role of Security in the Surface Transportation Programming Process* by Frederick J. Wegmann, Ph.D. and Jerry Everett, University of Tennessee

⁵ TCRP International Transit Studies Program. *Safety and Security Issues at All-Bus Systems in Small to Medium Sized Cities in Western Europe*. Research Results Digest, June 2003.

The first two of the four security steps, prevention and preparation, are the primary focus for MPOs; while transportation systems and facilities, particularly transit systems, may be called upon to help move personnel in response to a security event, such a response will be coordinated by a higher level of government. Transportation agencies are unlikely to take the lead in such situations. Furthermore, Response and Recovery are operational activities not appropriately addressed in the Metropolitan Transportation Plan.

Nevertheless, Prevention and Preparation may require substantial resources, both for training and for capital purchases, and these projects and programs, with their costs, should be considered and ranked in the MTP.

One writer raises questions about how the new focus on security will be dealt with: “Are existing planning tools and models altered? Is the process amended to incorporate security? Is security another goal to add to the list along with subsequent objectives and performance measures? Can one simply screen all the jargon in plans and replace the term safety with safety/security, or is there a distinct difference? Do security concerns merit changes in organizational charts, and how do the security responsibilities get spread across the federal, state, regional and local agencies involved in delivering transportation planning? Is security something that gets addressed in the public participation part of planning? How do the financial commitments to security initiatives get evaluated and how are tradeoffs made to reflect security concerns? And, is it premature to draw conclusions about how security impacts transportation planning?”⁶

This writer offers five “Simplified Planning Process Steps:”

1. Goal Development
2. Conditions Assessment
3. Needs Assessment
4. Project Identification
5. Project Programming

The same writer addresses the funding priorities that are central to an MPO’s work: “Investment Priorities -- Speculation has centered on whether security risks will have an influence on public attitudes toward transportation investments. Some have suggested that the economic value of transportation is being recognized, and this will aid efforts to increase investment in transportation. Others anticipate a renewed interest in having transportation choices; specifically enhanced funding for rail modes. Still others worry that diversions of dollars to enhance security will detract from capacity improvements...Transportation investment priority changes could result from a number of considerations.”⁷ Transportation resource pressures resulting from security concerns could include:

⁶ *Security Considerations in Long-Range Transportation Planning: A White Paper for the Arizona Department of Transportation* by Steven E. Polzin, P.E. Ph.D. for Cambridge Systematics

⁷ *Security Considerations in Transportation Planning: A White Paper* by Steven E. Polzin, P.E. Ph.D. for the Southeastern Transportation Center

- Diversion of resources to security needs outside of transportation programs
- Diversion of funds to operating security enforcement/policing/planning/training
- Diversion of funds to capital investments in security (barriers, fencing, etc.)
- Use of funds to support network redundancy/connectivity
- Use of funds to support modal choice/redundancy
- Diversion of funds to design changes/enhancements to increase security.

He continues: “Post September 11th, actions suggest a variety of possible investment needs as a result of increased sensitivity to security risks. These needs range from near-term initiatives to conduct strategic planning and assessments to supporting enhanced enforcement levels such as those found at airports, to longer-term needs to alter the physical characteristics of individual transportation investments and the system or network of investments. Changes could range from rerouting roadway alignments from sensitive sites to removing trash containers from rail station platforms. Enhancements to ITS technology as a tool to utilize in incident prevention and incident response have been contemplated and simple design changes to enable additional vehicle inspection queues at border crossings or luggage and passenger scanning capacity at airports may be necessary. Revisiting the capability of our transportation network to handle special vehicles or military equipment in response to incidents or the exploration of modifications in our roadway network to more easily enable mass exodus from an urban area in response to a crisis are among the more complex and expensive strategies that might be pursued. Other major financial obligations could occur if decisions to change the connectivity or range of modal options in our transportation system were to move forward. Several interests, for example, have proposed major investments in high-speed rail in order to provide an alternative to dependency on air travel for longer distance trips. Additionally, certain travel behavior changes could result in different demands for transportation by various modes than are currently anticipated. This could result in changes in modal priorities, shifting geographic priorities, changes in project costs due to design or other security related changes, or other shifts in long-range transportation facility and service plans.”

Bend Area Modal Security Data

A summary of Bend area modal security information is shown in Figure 13-3:

Figure 13-3 Summary of Bend area Modal Security Information

MODE	PREVENTION	PREPARATION	RESPONSE	RECOVERY
Transit – Bend Area Transit and Dial-a-Ride	Drivers receive training.	Security enhancements will likely be included with new bus acquisitions.	BAT may assist in movement of people during response.	BAT resources may be part of regional or local recovery plan.
Bend Airport	TSA is working with general aviation airports to assist them in appropriate planning.			
Rail - BNSF	Procedures for derailments in place. Emergency response planning is carried out on an ongoing basis. Reporting systems are in place for unauthorized access to hazardous materials. Hiring practices seek to ensure security through personnel screening.	See Prevention	Emergency response plans in place including a procedure to cooperate with local emergency responders.	Recovery plan is in place.
Highway	ODOT is working with local and state emergency managers, Oregon State Police, USDOT and others to identify transportation facilities that may require special consideration in planning for response to terrorist incidents.	ODOT employees are required to take terrorism awareness training.	Phase 1 is to report concerns to law enforcement & to cooperate with law enforcement. Phase 2 (consequence mgmt) is described in the ODOT Emergency Operations Plan.	ODOT will continue to provide essential services to the public by identified critical business functions. Critical Business Functions are in the ODOT Emergency Operations Plan.
Pipe (gas) and Power (electrical) lines: Central Electric Coop, Pacific Power and Cascade Natural Gas	A failure to a portion of the transmission systems leading to outages can be isolated from the entire system. There are established rules for practical safeguarding of employees and the public during installation, operations, & maintenance of systems.	Emergency response plans are in place. The plans provide guidelines regarding responses to specific emergencies to protect life, property, and the environment. The plans must also comply with OSHA regulations. Each company coordinates with other response agencies.	Crews are on call 24 hours a day.	Crews are on call 24 hours a day.

Policies

- Work with local agencies and jurisdictions to evaluate transportation security incident data by mode and identify appropriate policy and program directions.
- Continue Intelligent Transportation Systems planning and project programming, particularly with a view to investments that will enhance security.
- Regularly review the MTIP scoring matrix and other specific funding program scoring matrices to ensure that security projects receive appropriate weighting and priority in the MTIP.
- Regularly review the project identification and prioritization process for the Regional Transportation Plan (RTP) to ensure that security receives adequate priority in the development of the long range project list.
- Identify transportation funding sources that are specifically targeted at security projects, so that the limited funds from conventional transportation sources are not inappropriately redirected to this area.
- Support, through planning and programming, the installation, operations, upgrades, and timely maintenance of system infrastructure, including ITS applications, to provide for improved security.
- Work with local agencies and jurisdictions to analyze the transportation network for redundancies in moving large numbers of people (e.g., modeling person and vehicle flows with major links removed or reversed, accommodating street closures, adaptive signal control strategies, impact of traveler information systems), and strategies for dealing with possible “choke” points.
- Work with local agencies and jurisdictions to analyze the transportation network for emergency route planning and identification of strategic gaps in the network.

Chapter 14: Parking

Parking Chapter to be completed at a Later Date

Chapter 15: Aviation Systems

Introduction

This chapter addresses activities, issues and needs at the region's airports within and near the Bend Metropolitan planning area over the 20-year planning horizon.

Airport planning is generally conducted at three levels. Individual airports do Master Plans and Airport Layout Plans under Federal Aviation Administration (FAA) guidance that addresses their 20-year future. States do airport system planning by establishing a hierarchy of public use airports within the state, setting priorities for investment and management based on different goals and policies. The FAA also does its own airport-related planning through a number of documents, including the National Plan of Integrated Airport Systems.

Policies

Individual airports and local jurisdictions have their own policies, goals and objectives but are also guided by nine statewide aviation goals including:

1. Preserve investment in Oregon's system of airports and its level of service.
2. Protect airports from incompatible land uses.
3. Maintain Oregon's public-use airports so that they are safe, and ensure that the airport system can fulfill its role in the state's emergency response system.
4. Support economic development by providing access to regional, state, national, and international markets.
5. Provide access to the air transportation system and its connections with other modes for people and freight throughout the state.
6. Comply with state and federal environmental protection requirements.
7. Support efforts to ensure sufficient system capacity and airport modernization.
8. Seek adequate and stable statewide funding to preserve system airports.
9. Provide advocacy and technical assistance (from the State Aviation Department) for airports and their users.

The region has specific goals and policies outlined within the local transportation plans that are specifically related to aviation and were developed to help guide the future of the airports in the region. The relevant policies include:

1. Work with member agencies and jurisdictions to protect the function and economic viability of the existing public-use airports while ensuring public safety and compatibility between airport uses and surrounding land uses for public use airports and for private airports with three or more based aircraft.
2. Continue to recognize the Redmond (Roberts Field) Airport as the major commercial/passenger aviation facility in central Oregon and an airport of regional

significance. Its operation, free from conflicting land uses, is in the best interests of the citizens of central Oregon.

3. Work with, and encourage airport sponsors to work with the FAA to enforce FAA registered flight patterns and FAA flight behavior regulations to protect the interests of County residents living near airports.
4. Encourage appropriate federal, state and local funding for airport improvements at public-owned airports.
5. Work with local jurisdictions to discourage future development of private landing fields when they are in proximity to one another, near other public airports and potential airspace conflicts have been determined to exist by the Federal Aviation administration FAA or ODOT Aeronautics.
6. Participate in and encourage adoption and update of airport master plans for the Bend Municipal Airport and Redmond Municipal Airport.
7. Work with airport sponsors, local jurisdictions and transportation providers to evaluate and enhance opportunities for improving surface transportation options to the Bend Municipal Airport and Redmond Municipal Airport.

Facilities

Bend Municipal Airport

The Bend Municipal Airport is located approximately five miles northeast of the Bend Metropolitan planning area. It is a non-towered airport and classified as a Category 2 – Business or High Activity General Aviation Airport with no scheduled passenger service to/from the airport. The single asphalt runway is 75 feet wide and 5,005 feet in length serving approximately 42,000 annual aircraft operations (departures and arrivals) with an approximate average of 110 operations per day thus making it the 14th busiest airport in the state¹. The existing asphalt runway is in fair condition. Approximately 180 aircrafts in combination with 18 aviation type businesses are currently based at the airport. The airport was established in 1942 in response to World War II training efforts.

Redmond Municipal Airport ~ Roberts Field

Passenger air service is provided to the Central Oregon area at the Redmond Municipal Airport, located approximately sixteen miles north of Bend. The Redmond airport is classified as a Primary Service/Transport airport and is publicly owned. It provides scheduled passenger service and accommodates larger and higher performance aircraft than the Bend facility. The Redmond airport is currently served by three commercial carriers, Delta, Horizon Air, and United Airlines (including United Express). Currently, there are daily direct flights to several cities in the western U.S. This airport is not included in the Bend Metropolitan planning area.

The Bend Municipal Airport and Redmond Municipal Airport are outside of the Bend Metropolitan planning area. The Deschutes County regulations and County TSP policies govern land use issues that are associated with the use and operation of the airport. Key goals outlined in the Deschutes County TSP are related to the protection of

¹ Airport update #7, Bend Municipal Airport, April 18, 2006 (<http://www.ci.bend.or.us>)

public-use airports through the development of land use regulations based upon the adopted airport master plans. The purpose of these regulations is to prevent the installation of airspace obstruction, additional airport hazards and to ensure the safety of the public and guide compatible land use.

Forecasts and Future Needs

The Oregon State Aviation System Plan discusses five trends that will cause aviation activity growth in the state and within the Bend Metropolitan region including:

- Migration to Oregon;
- Growth in high-tech and export-oriented industries;
- Growth in tourism;
- Increase in air travel by general population; and
- Increase in number of retirees with high discretionary incomes.

Bend Municipal Airport

According to the most recent City of Bend Municipal Airport Plan, annual operations are forecast to increase from 25,000 in 1993 to 50,000 in 2013. Even with a doubling of activity over the 20-year planning period, the airfields system (runway and taxiway) will accommodate the forecast demand. Additionally, aircraft based at the Bend Airport are forecast to increase from 110 in 1993, to 165, in 2013. Bend has adequate paved tie-down areas to meet demand but will need to add hanger space to accommodate demand for covered aircraft storage.

The Oregon Aviation Plan² found runway length/width and weather reporting to be the key needs for the Bend airport in order to preserve the airport system over the next twenty years. Since this finding, an automated weather observation system capable of announcing wind speed, wind direction, current temperature and dew point, precipitation, cloud layers and ceiling up to 12,000 feet AGL, density altitude, barometric pressure (altimeter setting), visibility (1/4 mi to 10+ mi), and lightning strikes/activity within and beyond 10 miles³ has been installed. An additional runway is anticipated to be completed in October 2007.

Redmond Municipal Airport

According to the most recent Redmond Airport Master Plan⁴, the number of passenger enplanements is forecast to double from 147,106 in 2003 to 300,000 in the year 2023. Following a similar growth pattern the general aviation trends are expected to increase from 36,128 in 2003 to 67,400 in the year 2023. The plan evaluated airport needs over

² *Oregon Aviation Plan*, Oregon Department of Transportation, February, 2000.

³ Airport update #7, Bend Municipal Airport, April 18, 2006 (<http://www.ci.bend.or.us>)

⁴ *Redmond Municipal Airport Master Plan*, April 2005. Accessed online:
<http://www.ci.redmond.or.us/internet/content/view/104/212/>

a 20-year planning horizon and recommended a series of runway improvements to accommodate the forecast growth. The following list outlines key needs for the future:

- Longer runway length to accommodate aircraft flown by United States Forest Service. Runway 4-22 should be extended to a length of 8700 feet
- Construction of a new parallel runway (7000-8000 feet long, 150 feet wide)
- Segregated area for air cargo facilities
- Expansion of the existing terminal
- Up to 80 new storage spaces for small and large aircraft
- Taxiway modifications

The Oregon Aviation Plan cited runway length/width, taxiway access and REILS (runway end lighting system) as the primary deficiency areas for the Redmond Airport in the 20-year planning horizon. These deficiencies were also cited in the Redmond Airport Master Plan.

Chapter 16: Rail Systems

Introduction

Rail service in the Bend Metropolitan planning area serves an important role to the regional transportation system moving freight north and south through the study area and serving regional connections within the State of Oregon and beyond.

Between 2007 and 2009, ODOT funded and a multi-agency team developed the *Report on Central Oregon Rail Planning*. The report addresses various rail related safety, congestion, freight mobility, and economic development issues for Central Oregon. The report contains findings and recommendations including rail grade separations of Cooley and Reed Market Roads. The findings and recommendations from the report will be incorporated in Stage 2 of the MTP update process.

Facilities

Freight Rail

Burlington Northern Santa Fe (BNSF) and Union Pacific (UP) currently operate trains through the Bend Metropolitan planning area. The rail track, owned by BNSF, runs parallel to Highway 97 at the north city limits before veering east just south of Colorado Avenue towards the industrial zone. The rail track is regulated under the Federal Railroad Administrations (FRA) class 2, 3 and 4 track standards; there are no weight or dimensional restrictions for freight movements through the study area. As a result, rail can handle much heavier loads as well as longer loads than those normally permitted on highways. A modern rail car can handle the same cargo that would require three to four semi-trucks to handle.

BNSF and UP combined for an estimated 13 million gross ton miles being transported through the study area in 2002¹. In 2005, BNSF was operating approximately 12-15 trains per 24 hours through the study area, while UP was operating one train daily in each direction. Additionally, BNSF operates a switch engine which transports freight to and from local businesses within the study area. The majority of freight being transported through the study area consists of various forest products, cement, diesel fuel, liquefied petroleum gas, wallboard, and other construction supplies.

Passenger Rail

There is currently no passenger rail service in the Bend Metropolitan planning area. The nearest connection to passenger rail service in central Oregon is in the town of Chemult, which is located about 70 miles south of Bend. The feasibility of extending AMTRAK service to the Bend area was analyzed during the development of the 1992 Oregon Rail Passenger Policy Plan. The study concluded it would be impractical to

¹ Email from Bob Melbo of ODOT Rail Division to Tyler Deke of Bend MPO, January, 2006.

provide passenger service to Bend. In 2000, the state funded two “throughway” bus connections with AMTRAK that pass through Bend. One travels from Portland to Boise, Idaho and the other connects the Chemult rail station with the Bend area. The Oregon Rail Plan² does not currently identify any future plans for passenger rail service serving the Bend Metropolitan planning area.

At-Grade Rail Crossings

The majority of the rail crossings within the study area are at grade. There are seventeen total crossings over the freight rail line traversing the study area. Eleven of the crossings are at grade and utilize active traffic control devices; the remaining crossings are over grade or under grade. The rail crossings are shown in Figure 1-12 (from the existing conditions chapter).

Forecasts and Future Needs

Overall, rail freight in Oregon is projected to be the second fastest growing mode of transportation behind vehicle travel. Oregon’s freight rail traffic totaled 63.5 million tons, handled to, from, within and through the state in 1999. Rail freight volumes, as well as truck freight volumes are forecast to double by 2020 in the state of Oregon and nationally. No regional rail forecasts for the Bend Metropolitan planning area are available.

Throughout the 20-year planning period, the railroad line through the study area will continue to haul freight. The existing railroad switching yard depot, weigh station and sidings are expected to remain unchanged and there are no planned changes to the existing pattern of short spur rail lines that serve local freight rail users.

The Bend Transportation System Plan includes two future rail crossings in the 20 year planning time frame. One future crossing is an eastward extension of Murphy Road (a collector) to 15th Street. This new road/railroad crossing will be grade separated. Another proposed railroad under crossing is proposed at Hawthorne Avenue. A detailed analysis (for the future need of the Hawthorne connection) should be evaluated when it is necessary to improve east-west capacity in the downtown to Third Street.

Historically, train delays at road/railroad crossings have not been a major traffic problem in the Bend Metropolitan planning area, with the exception of the Reed Market Road crossing. As a result of the *Reed Market Corridor Study*, it is recommended to grade separate the rail crossing at Reed Market Road from Paiute Way to 9th Street. As part of this grade separation, consideration will have to be given to improving the direct connection for motor vehicles between 9th Street (to the north) and American Lane (to the south). This may include a system of frontage roads.

² *Oregon Rail Plan* Oregon Department of Transportation, 2001. Accessed online:
<http://statelands.dsl.state.or.us/ODOT/RAIL/docs/railplan01.pdf#search=%22oregon%20rail%20plan%22>

As traffic volumes increase, other train crossings may contribute to increased traffic interruptions, specifically on arterial roadways. Potential solutions include coordination with railroad authorities to minimize crossings during peak driving periods or grade separation.

Policies

The region has specific goals and policies outlined within the local transportation plans that are specifically related to rail service and were developed to help guide the future of the regional railroads. The following policies are primarily related to safety and expanded usage of the existing rail lines and are applicable to the Bend Metropolitan planning area.

1. Maintain the existing levels of freight rail activity throughout the Bend Metropolitan planning area while also encouraging expanded usage by commercial and industrial companies.
2. Increase the safety of existing at-grade crossings and work towards the eventual replacement of priority at-grade crossings with grade-separated crossings.
3. Work cooperatively with affected local jurisdictions and railroad operators to reduce land use conflicts and increase safety at all at-grade crossings;
4. Encourage efforts to improve the condition of rail lines throughout the Bend Metropolitan planning area in order to retain the effectiveness and competitiveness;
5. For rail lines being considered for abandonment, work cooperatively with the applicable parties to evaluate opportunities for converting the rail line to multi-purpose trail use. If the rail line is converted to multi-purpose trail use, the trails should be incorporated into the applicable local trail system plans;
6. Work cooperatively with the railroad operator to determine where, if possible, railroad right-of-ways could be used as trail corridors. Provided local joint-use agreements can be reached with the railroad operator, work with local jurisdictions to evaluate the entire Rails to Trails Corridor in light of opportunities to augment the local primary trail system. If trails are identified and developed, the trails should be incorporated into the applicable local trail system plans;
7. Work cooperatively with affected local jurisdictions, businesses and railroad operators to protect all rail spurs that currently serve businesses or have the potential to serve freight rail uses from abandonment or incompatible zoning; and
8. Work cooperatively with the railroad operator to develop and implement a plan for train scheduling to ensure that the current needs of the transportation system in the study area are minimally affected.
9. Work cooperatively with the railroad operator to evaluate opportunities for minimizing noise impacts associated with rail operations.

Chapter 17: Pipeline Systems

Transmission Pipelines

Two major natural gas transmission lines serve the Bend Metropolitan area. Gas Transmission Northwest Corporation (TransCanada) currently operates high-pressure natural gas pipelines that run near Bend city limits. These pipelines extend between Kingsgate, British Columbia and Malin, Oregon traversing a distance of 612 miles. These pipelines currently pass through the southeast corner of the city limits and consist of 36-inch and 42-inch diameter pipelines that are capable of delivering up to 1 billion cubic feet (BCF) of gas per day to the Pacific Northwest; however typical daily operations are in the range of 600-700 million cubic feet per day¹.

Cascade Natural Gas holds the role of distributing natural gas to the City of Bend through a system of 2-6 inch diameter piping. The maximum allowable operating pressure for the pipeline system is 911 pounds per square inch (psi). No other major utility pipelines serve, pass, or are currently planned through the Bend metropolitan area.

Other transmission lines for electricity, telephone, cable and internet services exist throughout the planning area. There is no known existing or future capacity constraints for pipeline or transmission line service within the Bend Metropolitan planning area.

Policies

1. Work cooperatively with the pipeline operator when planning any transportation system improvements that might impact the major gas transmission lines.
2. Work cooperatively with affected local jurisdictions to reduce land use conflicts and increase safety at all transportation system crossings of major transmission lines.

¹ Phone conversation with Robert Latimer, TransCanada GTN & NBP System, May 9, 2006.

Chapter 18: Environmental Considerations

Introduction

This chapter was originally prepared in spring 2007 to establish environmental baseline conditions in the Bend Metropolitan Planning Organization (BMPO) boundary for the development of the Bend Metropolitan Transportation Plan (MTP). This chapter was refined in summer 2014 as part of the MTP update. This update consisted of reviewing National Environmental Policy Act (NEPA) documentation prepared within the BMPO boundary since 2007 for applicable information, referencing actions completed since 2007, and collecting readily available online data. Most of the chapter and all the maps refer to information collected in 2007. A comprehensive update to this chapter is anticipated to occur in 2015.

The Environmental Considerations chapter is a requirement of the federal transportation legislation. In 2007, this federal legislation was Safe, Accountable, Flexible, Efficient Transportation Equity Act – A Legacy for Users. It remains a requirement under the 2012 Moving Ahead for Progress in the 21st Century Act [MAP-21]. MAP-21 requires that the BMPO long-range transportation plan include a discussion of the types of potential environmental mitigation activities and potential areas to carry out these activities, including activities that may have the greatest potential to restore and maintain the environmental functions affected by the plan. Addressing environmental considerations early in the transportation planning process ensures environmental impacts from transportation projects are minimized reducing overall project costs and impacts. This chapter:

- 1 Identifies existing environmental features within the BMPO boundary using maps and text.
- 2 Compares proposed transportation projects to the environmental conditions and identifies any potential conflicts that could result from the plan.
- 3 Identifies activities that may have the greatest potential to restore and maintain the environmental functions affected by the transportation plan.

MAP-21 requires that jurisdictions develop these analyses in discussion with Federal, State, and tribal wildlife, land management, and regulatory agencies.

This chapter should to be used as a starting point for analyzing the environmental consequences of transportation projects. When projects are proposed, this chapter should be reviewed to determine if there are potential environmental conflicts. If potential conflicts are identified, further information will be needed and further consultations with agencies with jurisdiction may be required.

Chapter Organization

The BMPO Environmental Considerations Chapter is a map-based product. The chapter is divided into ten sections with numerous specially developed maps to aid in

analysis of resource identification. In 2007, GIS data layers were secured from a wide variety of sources and combined into maps that illuminate baseline conditions for resources in 2007, and the maps aid in conflict identification. The maps are located in Appendix F and the supporting metadata is in Appendix F. The chapter is divided into the following ten sections:

- Land Use & Infrastructure
- Water Resources
- Fish, Wildlife & Habitat Resources
- Hazards
- Climate Change
- Air Quality
- Scenic Resources
- Historic and Cultural Preservation
- Recreation Resources
- Environmental Justice
- Noise

Each of the above sections is structured with the following headings: Summary, Methodology, Findings, and Recommendations. Below is an outline of what the reader can expect to learn in each section.

Summary: The summary gives the reader a very quick overview of what the section includes and any identified conflicts and recommended actions. It includes:

- A definition of what the section includes.
- A brief summary of data collected and agencies consulted.
- Identification of other sections that should be reviewed concurrently.
- Highlights of findings – resources and impacts identified.
- Highlights of recommendations.

Methodology: This section is designed to give the reader details on the type of data collected and agencies contacted for the original development of this chapter in 2007. This section has the following parts:

- List of agencies consulted
- Table of documents reviewed
- Table of maps developed with data layers and sources identified
- Missing, unavailable or inadequate data identified.

The majority of information is derived from available data. However, all of the maps are new compilations of data collected in 2007 layered to allow for a more comprehensive look at potential impacts of the transportation plan.

Findings: This section provides the reader with information about what resources were identified in the study area and how they might be impacted. It includes:

- Identification of environmental or cultural resources.
- Identification of regulations or protections in place.
- Identification of potential conflicts between resources and proposed transportation projects.

Recommendations: The section provides recommended activities to avoid, reduce or minimize identified conflicts with the transportation plan. This section includes:

- Identification of activities that may have the greatest potential to restore and maintain the environmental functions affected by the transportation plan
- Identification of further work to be accomplished in updates of this document.

Coordination

During the initial development of the Environmental Considerations Chapter in 2007, the BMPO coordinated with numerous agencies. Coordination involved consultations and meetings, contact via email, phone or letter, website database searches, or presentations to the following agencies:

- Bureau of Land Management (BLM)
- Burns-Paiute Tribe*
- City of Bend
- Confederated Tribes of Warm Springs
- Deschutes County
- Klamath Tribe*
- Oregon Department of Environmental Quality (DEQ)
- Oregon Department of Fish and Wildlife (ODFW)
- Oregon Department of Land and Conservation (DLCD)
- Oregon Department Of State Lands (DSL)
- Oregon Department of Transportation (ODOT)
- Oregon State Historic Preservation Office (SHPO)
- U.S. Army Corps of Engineers (USACE)
- U.S. Department of Commerce, National Marine Fisheries Service (NMFS)
- U.S. Department of Transportation Federal Highway Administration (FHWA)
- U.S. Environmental Protection Agency (EPA)
- U.S. Fish and Wildlife Service (USFWS)
- Upper Deschutes Watershed Council (UDWC)
- U.S. Forest Service, Deschutes National Forest

*no response received

A presentation was given to Oregon's state and federal transportation and environmental agencies (called CETAS, Collaborative Environmental and Transportation Agreement for Streamlining) on May 15, 2007, to share preliminary

elements of this chapter and receive comment. The members present at the meeting are listed below and the minutes of the meeting are in Appendix F.

Hal Gard, ODOT	Susan Haupt, ODOT	Michelle Eraut, FHWA
Yvonne Vallette, EPA	Charlotte Kucera, NMFS	David Leal, USFWS
Joyce Cohen, ODOT	Eric Metz, DSL	Michael Turaski, USACE
Corey Saxon, DEQ	Mollie Manion, SHPO	Art Marin, ODFW

Highlights of Results

The BMPO encompasses 47 square miles and includes two jurisdictions – the City of Bend and Deschutes County. The entire City and its Urban Growth Boundary are contained within the BMPO with County land forming a ring around the BMPO. The population of the area is estimated to be 83,794 in 2010 per U.S. Census data for the Bend urban area. While the BMPO is highly scenic and has significant environmental resources, there are relatively few identified conflicts between the proposed transportation projects and environmental resources. This is primarily due to the small number of rivers, streams and wetlands; an historic absence of anadromous fish; and the nature of the transportation projects proposed. The transportation projects proposed consist primarily of improvements to existing roads. There are few new roads proposed. This could change in the future and the information in this document and the map layers gathered should provide information necessary for analysis of future planning efforts. The major environmental conflict from transportation projects is stormwater runoff. Stormwater runoff impacts fish and wildlife, water quality, and results in flooding of major intersections. Other potential conflicts include wildlife crossings, air quality and climate change and restricted lands. Recommendations to avoid, reduce or mitigate identified conflicts include employing the best management practices in the City of Bend Integrated Stormwater Management Plan and the Stormwater Master Plan, maintaining wildlife linkages, adopting the transportation actions identified in the Oregon Strategy for Greenhouse Gas Reduction, and identifying all 4(f) and 6(f)(3) properties prior to pursuing transportation projects.

Overarching Recommended Policies

See also the specific recommendations at the end of each section of this report.

1. Potential impacts to the environment including, but not limited to air, water resources, fish, wildlife, native plants and habitat, and scenic resources shall be identified and considered in the initial planning stages of any BMPO transportation project and prior to funding and design of the project.
2. Potential impacts to cultural resources including but not limited to recreation, environmental justice, historic sites and archeological sites shall be identified and considered in the initial planning stages of any BMPO transportation project and prior to funding and design of the project.
3. Potential impacts to either the environmental or cultural resources from proposed BMPO transportation plans shall be evaluated through consultation with appropriate federal, state, tribal and local agencies.

4. Minimizing adverse impacts shall be evaluated in the following priority order:
 - a) Avoid adverse impacts by not taking an action.
 - b) Minimizing impacts by limiting the degree of action.
 - c) Rectifying by repairing, rehabilitating, or restoring the affected environment.
 - d) Reducing or eliminating impacts over time through preservation and maintenance activities.
 - e) Compensating for an impact by replacing or providing substitute resources or environments. In most mitigation agreements, more of a resource or habitat must be provided than was originally present. Ratios greater than 1:1 are required in part to compensate for unrealized losses and the inability of technology to completely restore the natural environment.
5. All mitigation measures shall include the following items to be adopted concurrently with the mitigation measure:
 - a) A funding mechanism sufficient to provide adequate funding, calculated from an average annual budget, to support the on-going maintenance needs of the mitigation, for the life of the mitigation. Mechanism could include performance bonds, endowment, taxing districts or other methods.
 - b) On-going funding shall include, but is not limited to, on-going facility maintenance, equipment replacement costs, personnel, public education, and monitoring costs for the life of the mitigation.
 - c) A monitoring and evaluation program with measurable goals, sufficient to determine if the mitigation is working or not.
 - d) Adaptive management protocols with milestones for implementation tied to the monitoring and evaluation program.
 - e) Enforcement mechanism with penalties sufficient to cover costs.

Recommendations at a Glance

Each of the recommendations below is found at the end of the appropriate section. They are shown here for a quick overview.

Water Resources

To avoid or mitigate potential impacts to water quality it is recommended that the best management practices in the City of Bend Integrated Stormwater Management Plan and the Stormwater Master Plan be employed when building or retrofitting transportation projects.

Future Work to be Completed

- Identify all service stations and define specific transportation routes for fuel delivery. Prioritize stormwater management along those routes.
- Identify and define specific transportation routes for transportation of hazardous materials. Prioritize stormwater management along those routes.
- Map the remaining 25 drainage areas of concern for flooding on Map 5, Water Quality.

Fish, Wildlife and Habitat

Habitat

Design transportation projects to avoid and minimize the destruction of significant natural resources wherever possible. See general policies for more.

Bull trout and redband trout

Identify and explore methods to protect, restore, and maintain suitable habitat conditions for bull trout and redband trout for all transportation projects, especially those near the Deschutes River or Tumalo Creek, including the following:

- Maintain or improve water quality.
- Stabilize roads, crossings, and other sources of sediment delivery.
- Identify fish passage barriers or sites of entrainment and implement tasks to provide passage and eliminate entrainment.
- Screen water diversions and irrigation ditches.
- Restore connectivity and opportunities for migration by securing instream flows and/or water rights.

Invasive species

- Design transportation projects to prevent the spread of noxious weed species.

Wildlife Linkages

The design of new transportation projects and the retrofit of existing projects shall include the identification of any wildlife movement issues and a review of best management practices to facilitate wildlife movement to improve human and wildlife safety, decrease habitat fragmentation and property damage. Include mapped wildlife movement areas of concern upon their completion by Oregon Department of Fish and Wildlife.

Hazards

Future Work to be Completed

There may be additional activities recommended for specific species including bats that should be identified.

- Consideration of wildfire and other emergency evacuation routes should be taken into account in the design of transportation projects.
- Further investigation of the issues involved with railroad transport should be conducted, specifically the potential for toxic releases and railroad maintenance.
- Transportation projects near Tumalo Creek should analyze potential flooding impacts and channel migration potential and develop mitigation if impacts are identified.

Climate Change

In 2011, the Land Conservation and Development Commission (LCDC) adopted per capita GHG emission reduction targets for light-duty vehicles for all six metropolitan areas within Oregon. The target for the Bend MPO is to reduce emissions 18% per

person from 2005 levels by year 2035 (Oregon Administrative Rule [OAR] 660-044 – Metropolitan Greenhouse Gas Reduction Targets).

The Bend MPO should consider adopting the transportation actions identified in the Oregon Strategy for Greenhouse Gas Reduction that are appropriate for the BMPO.

Mitigations measures from the Oregon Strategy for Greenhouse Gas Reduction are designed to reduce greenhouse gas emissions from consumption of fossil fuels by displacing conventional combustion engines with hybrid, electric and other technological/fuel options, and to guide land use choices, especially in Oregon's urban areas, toward more efficient choices including higher densities, transit options, mixed-use neighborhoods, and common wall dwelling designs. Mitigations should be updated as new information becomes available. Among the recommend actions outlined in the report that may be appropriate for the BMPO are:

- Integrate land use and transportation decisions with greenhouse gas consequences.
- Promote alternative fuels use and production.
- Incorporate greenhouse gas emission impacts into transportation planning decisions.
- Promote better management and use of parking
- Support and implement demand management programs
- Encourage bicycling and walking for short trips
- Support development of carsharing programs
- Support development of more sustainable funding sources to support maintenance and operation of the transportation system
- Set up traffic engineering "Best Practices"
- Improve mass transit and inter-city transit links.

Other recommendations:

- Work with the City of Bend to conduct a carbon inventory and consider crafting a comprehensive carbon emissions reduction plan.

Air Quality

To analyze the impact of proposed transportation projects to air quality:

- Use the transportation demand model, the complimentary air quality models, and the emissions inventory to assess the air quality impacts of transportation system improvements.

See also the recommendations in the Climate Change section of this report for other actions that will mitigate air quality conflicts.

Scenic Resources

- For all transportation projects, review the Scenic Resources map and identify and potential conflicts.

- For the Cooley Road extension project: Design the project to avoid impacts to the State Scenic Waterway and the County Landscape Zone.

Historic and Cultural

- Consult with the Bend Landmarks Commission and the State Historic Preservation Office on a case-by-case basis for each proposed transportation project to determine if there is the presence of any historic or archaeological resources or Section 4(f) properties.
- For any Section 4(f) properties identified, property boundaries shall be defined (including any structures) and jurisdictional responsibilities identified. The BMPO shall work with the responsible jurisdiction to avoid impacts to the 4(f) properties according to federal requirements.

Recreation Resources

In the early stages of planning for transportation projects in the BMPO, a survey should be conducted to identify all 4(f) and 6(f)(3) properties. Property boundaries defined and jurisdictional responsibilities should be identified. The BMPO should work with the responsible jurisdiction to avoid, reduce or minimize impacts to the 4(f) or 6(f)(3) properties consistent with requirements outlined in the respective regulations.

Environmental Justice

Avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations.

Ensure that the long-range transportation plan and the transportation improvement program comply with federal Title VI requirements.

Future work to be Completed

- Conduct further analysis as new census data becomes available.
- Identify residential, employment, and transportation patterns of low-income and minority populations so that their needs can be identified and addressed, and the benefits and burdens of transportation investments can be fairly distributed.
- As resources allow, conduct an environmental justice/Title VI of the Civil Rights Act of 1964 assessment of the BMPO Transportation Improvement Program and Public Participation Plan.¹
- As resources allow, update the BMPO Public Participation Plan prepared in 2009, which encourages participation and engagement of minority and low-income populations in transportation decision-making, such as by providing Spanish translations of printed materials and at meetings if needed.

¹ Any agency receiving federal funding must comply with Title VI of the Civil Rights Act of 1964 and Executive Order 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations). An assessment would evaluate the consistency of TIP and Public Participation Plan with Title VI and Executive Order 12898.

Land Use & Infrastructure

Summary

The Land Use and Infrastructure section of this chapter provides an introduction to the BMPO area. The BMPO includes two jurisdictions – the City of Bend and Deschutes County. The entire city and its Urban Growth Boundary are contained within the BMPO with County land forming a ring around the BMPO. Three maps provide background information for this report. Map 1 is a relief map of the area; Map 2 is a zoning map with both City of Bend and Deschutes County zones; and Map 3 is a map of utilities including sewer lines and other infrastructure. While the BMPO is highly scenic and has significant environmental resources, the proposed transportation projects have relatively few identified conflicts between the proposed transportation projects and the resources. This is primarily due to the small number of rivers, streams and wetlands, historical absence of anadromous fish, and the nature of the transportation projects proposed.

Methodology

The following agencies were the primary resources for this section although other agencies, organizations and individuals may also have been contacted.

- City of Bend
- Deschutes County

The following were the primary documents reviewed for this section:

Title	Source	Date
Collection System Master Plan, Final Report	City of Bend	2006
City of Bend General Plan & Zoning Code	City of Bend	1998, 2006
Deschutes County Comprehensive Plan & Zoning Code	Deschutes County	2005, 2001
Community Profile and Trends Report, Bend 2030, Our Community Vision	City of Bend	2006

Documents focused on specific parcels of land or areas within the BMPO were also reviewed including:

Title	Source	Date
Draft Stevens Road Tract Master Plan	Cogan Owens Cogan, LLC et. al. for the Oregon Department of State Lands	December 1, 2005
Reed Market Corridor Study, Draft Existing Conditions Technical Report	Parametrix, Inc., for City of Bend	June 2005
Juniper Ridge Concept Plan	Otak, for City of Bend	August 2005
Bend Parkway Final Environmental Impact Statement	Oregon Department of Transportation	August 1992
City of Bend Central Area Plan	City of Bend	2007
Murphy Road Corridor Project, Existing Conditions and Deficiencies	CH2M Hill, for City of Bend	December 2006

Digital data layers were combined to create maps depicting information available in 2007. The following are the map titles along with the data layers shown and the source of the data. For details on the metadata see Appendix F.

Map #	Map Name	Data Layer	Source
1	Relief Map	Hillside Relief	Deschutes County
2	Zoning	City Zoning	City of Bend
		County Zoning	Deschutes County
3	Utilities	Proposed Gravity Interceptors	City of Bend
3	Utilities	Pressure Mains 10" and over	City of Bend
3	Utilities	Gravity Mains 10" and over	City of Bend
3	Utilities	Water lines over 8"	City of Bend
3	Utilities	Avion Water Lines Over 8"	Avion Water District

Findings

The BMPO encompasses 47 square miles, most of which is within the City of Bend city limits with a ring of Deschutes County land surrounding the City. The area is located in the high desert, which receives an annual average of 11.6 inches of rain and 34 inches of snow. The City of Bend averages about ten days per year with temperatures over 90 °F with winter lows between 20 °F and 30 °F on average. The area is defined by the Cascade Mountain range to the west (which receives a mean annual precipitation of 140 inches), the desert to the east, and the Deschutes River running north and south through the middle of the planning area. The population of the BMPO area was approximately 83,796 in 2010 (per U.S. Census data for the Bend urban area). The area was among the fastest growing areas in the nation between 2000 and 2010. Highway 97 runs north and south and Highway 20 runs east and west through the BMPO.

While there are significant environmental resources in the BMPO, they are relatively confined geographically. For example, there are only two water bodies in the BMPO, the Deschutes River and Tumalo Creek, and no identified wetlands other than those associated with the riparian areas along the Deschutes River within the city limits. There are no anadromous fish (they are blocked naturally by Big Falls north of the BMPO). Bull trout and bald eagle are two species with recovery plans in the region. Stormwater is a big concern for the area, which received a National Pollution Discharge Elimination System Stormwater Discharge Permit in February 2007. There are two historic districts and hundreds of historic buildings in the BMPO but they are not anticipated to be impacted by the proposed projects. There are many archeological sites, only a few of which are identified on the map. Most archeological sites will have to be identified on a case-by-case basis as projects are proposed. Transportation projects proposed in the BMPO are primarily related to improvements to existing intersections and roads.

Recommendations

There are no activities proposed for this section, which provides general background information.

Water Resources

Summary

The Water Resources section of this chapter focuses on quality and quantity of surface and groundwater in the BMPO and includes public health issues affecting drinking water. Data were gathered from a wide variety of sources including the Department of Environmental Quality, the City of Bend Public Works Department, and the Upper Deschutes Watershed Council. Documents reviewed include stormwater plans and permits, subbasin assessments and other water-related documents. This section should be reviewed along with the section on Fish, Wildlife and Habitat, as water issues discussed in this section are closely related. There are four maps pertaining to this section. They are: Map 4 - Stormwater; Map 5 - Water Quality; Map 6 - Environmental Health; and Map 7 - Irrigation Service Areas.

This is probably one of the more complex and important sections of this chapter in part due to the emerging stormwater management and water quality activities underway at this time, and the complicated nature of the interplay of surface and groundwater in the area. Impacts resulting from over 100 years of stormwater discharges to the Deschutes River and underground through injection wells, along with heavy manipulation of the river flows using dams and irrigation diversions are identified in this section. To avoid or mitigate potential impacts to water quality it is recommended that the best management practices in the City of Bend Integrated Stormwater Management Plan and the Stormwater Master Plan be employed when building or retrofitting transportation projects.

Methodology

The following agencies were the primary resources for this section although other agencies, organizations and individuals were contacted.

- Central Oregon Intergovernmental Council
- City of Bend
- Oregon Department of Environmental Quality
- Oregon Water Resources Department
- Upper Deschutes Watershed Council

The following were the primary documents reviewed for this section:

Title	Source	Date
Central Oregon Stormwater Manual	Central Oregon Intergovernmental Council	May 2007
City of Bend Water Quality Monitoring Project: Technical Report 2004	City of Bend, Upper Deschutes Watershed Council	June 2005
City of Bend Public Works Department Stormwater Master Plan Project Fact Sheet	City of Bend	January 2007
City of Bend Stormwater Master Plan	City of Bend	August 2014
Integrated Stormwater Management Plan	City of Bend, Public Works Department	November 2006
National Pollution Discharge Elimination System Stormwater Discharge Permit	Oregon Department of Environmental Quality	February 26, 2007
NPDES Permit for Stormwater Discharges: Permit Evaluation Report and Fact Sheet for the City of Bend	Oregon Department of Environmental Quality	2007
Oregon Department of Environmental Quality website - Leaking Underground Storage Tank (LUST) Cleanup Site Database	Oregon Department of Environmental Quality	July 2014
Oregon's Phase II Municipal Stormwater Program - Fact Sheet	Oregon Department of Environmental Quality	November 26, 2006
The Bend Riverway, A Community Vision	Bend Park and Recreation Foundation	July 1999
United States Department of the Interior Geological Survey	U.S. Geological Survey	2001
Upper Deschutes Subbasin Assessment	Upper Deschutes Watershed Council	August 2003

Digital data layers were combined to create maps depicting environmental information for water resources in 2007. The following are the map titles along with the data layers shown and the source of the data. For details on the metadata see Appendix F.

Map #	Map Title	Data Layer	Data Source
4	Stormwater	Catch Basins, Drill Holes, Dry Wells	City of Bend; Deschutes County
		River Discharges	City of Bend
5	Water Quality	Impacted water data (303[d])	Department of Environmental Quality 2002
		Sub basin Delineation	City of Bend
		Drainage Problem Areas	City of Bend
6	Environmental Health	Public Drinking Water Wells, and Well Protection Areas	City of Bend
		Railroads	Deschutes County
		Water Service Area - Avion	Avion Water
		Water Service Area - City	City of Bend
		Water Service Area - Roats	Roats Water District
		Location of Service Stations	Deschutes County
7	Irrigation Service Areas	Canals	Deschutes County
		Irrigated Land – Arnold Irrigation District	Geo-Spatial Solutions
		Irrigated Land - Central Oregon Irrigation District	Central Oregon Irrigation District
		Irrigated Land – Swalley Irrigation District	Deschutes County
		Irrigated Land – Tumalo Irrigation District	Deschutes County

Notes about the Data

A data layer from 2002 from the Oregon Department of Environmental Quality is included on Map 5. The data layer does not exactly match the data in the table, which is more current than the map. (The map does not show that Tumalo Creek is water quality impaired for temperature.)

Not all of the service stations are identified on Map 6 and areas zoned for service stations are not identified.

See Appendix F for more information on the metadata for these maps.

Findings

Surface Water

The BMPO encompasses approximately 47 square miles much of which is impervious surface. The average annual precipitation in the area is 11.6 inches with 34 inches of snowfall on average. There are two natural surface water bodies in the BMPO: the Deschutes River which runs north and south through the middle of the area, and Tumalo Creek which crosses the northwest corner of the BMPO.

The Deschutes River is 252 miles long from its headwaters in the Cascade Mountains, with about 14 miles of the river within the BMPO boundary. The Deschutes River originates at Little Lava Lake, which is supplied with water from subsurface flows and springs. The volcanic soils in the area have a high level of permeability that allows precipitation to sink easily into the ground and eventually reach the water table. Before dams were constructed, the Deschutes had a flow regime described in 1914 by the U.S. Reclamation Service, which stated in a report, "The flow of the river is one of the most uniform of all streams in the United States, not only from month to month, but also from year to year."

The Deschutes River is primarily a spring-fed system and the groundwater is linked to surface water, which significantly affects the surface flows. Groundwater is discharged downstream of the BMPO in very significant amounts (a 10-fold increase has been measured between river mile 138 and 120) which alters the hydrology of the surface water.

As early as 1901 irrigation diversions were beginning to be constructed on the Deschutes, and by 1920 there were four dams and five diversions within the BMPO and one diversion (Arnold Irrigation District) just upstream from the BMPO boundary. Near the headwaters of the Deschutes, Crane Prairie Dam began regulating the water flow in the river in the 1920's and Wickiup Dam began regulating water flow in 1949, disrupting the naturally stable year-round flows. Winter water storage and summer water releases at Wickiup Reservoir, in combination with downstream diversions, contribute to significant fluctuations in flow levels. In the vicinity of the BMPO, summer high flows above the BMPO boundary reach 2,100 cubic feet per second (cfs) while below the BMPO boundary flows are reduced to as low as 30 cfs. This dramatic fluctuation in flow has been linked to a variety of water quality impacts.

Irrigation canals are common throughout the BMPO. They intersect the transportation system by crossing roads in many locations and may significantly increase the cost of transportation projects over or near canals. The cost may be prohibitive and cause projects to be rerouted to other areas.

Tumalo Creek is a much smaller creek with fewer diversions than the Deschutes. It originates from springs and snowmelt in the Cascade Mountains west of Bend. The creek is a tributary of the Deschutes River joining it just outside the north BMPO boundary. Drinking water diversions from Bridge Creek (a tributary of Tumalo Creek upstream) and irrigation diversions severely limit summer streamflow. During the peak of the irrigation season and during winter stock runs, more than 90% of the in-stream flow is often diverted (Jones, 2005). The Deschutes River Conservancy has implemented innovative methods, such as irrigation season leasing and water rights transfers and conservation projects, to improve streamflow and improve water quality in the Deschutes River.

Groundwater

The geology and hydrology, including the connection between surface water and the underground movement of water, is very complex and unique in Central Oregon. The report Ground-Water Hydrology of the Upper Deschutes Basin, Oregon prepared by the U.S. Geological Survey in 2001 (Gannett, 2001) states that groundwater and surface water are directly linked in the Deschutes Basin and removal of groundwater will ultimately diminish stream flow in some parts of the river (Fick, 2007, Yake, 2003). The link between surface and groundwater is important to consider in discussing downstream and regional impacts from transportation projects in the BMPO.

In general, the geology of the area includes lava beds that sit on top of several hundred feet of volcanic and sedimentary rocks. The subsurface geology of the upper Deschutes Subbasin defines and directs the storage and flow of groundwater. Although basalt itself is not very permeable, the fractures and joints between lava flows do allow a substantial amount of water to pass through (Bastasch, 1998). Soils in the subbasin are generally very shallow and highly permeable. In many areas, these soils are underlain by large areas of impermeable consolidated pumice, which prevents infiltration (Fick, 2007).

Adding to the complexity of this river system are the diversions of the Deschutes River and Tumalo Creek for irrigation and the many miles of unlined canals. These canals leak approximately 46% of the water diverted from the river back into the groundwater, which may contribute almost 13% to annual groundwater recharge in the area (Gannett, 2001). River flow is diminished between where the irrigation water is withdrawn and where it rejoins the river through the groundwater connection. The distance may be many miles apart.

The groundwater is recharged by a combination of precipitation, canal leakage, infiltration of applied irrigation water that percolates below the root zone, and leakage from streams. There is a strong connection between the amounts of precipitation and groundwater recharge rates. Approximately 84% of recharge due to infiltration of precipitation in the Deschutes Basin occurs between November and April from snowfall in the High Cascades, (Gannett, 2001).

Drinking Water

There are two aquifers underlying the BMPO. A deep underground river-like aquifer moves from the southwest across the BMPO to the northeast. At a depth of approximately 300 feet or more, this aquifer is the source of about half of the City of Bend's drinking water (Map 6). Shallow aquifers are located above the deep or "principal" aquifer but are not a source of municipal drinking water. However, there are many non-municipal water wells that withdraw from this shallow aquifer. Many of these shallow aquifers are fed by canal leakage (Fick, 2007).

Approximately half of the City's potable water is obtained from water wells tapping the deep aquifer and this amount of withdrawal is expected to grow in the future. Yields from wells in the area may be as high as 2,000 gallons per minute. Most municipal wells have yields in the 750 to 2000 gallons per minute range (Yake, 2003). The general

water table ranges from approximately 500 or more feet deep at the City of Bend rising to 200-300 feet deep near Redmond. This is due to a northerly downward sloping trend in the ground surface elevation (Gannett, 2001). Monitoring of the deep groundwater has occurred over the years and none of the data reveal a pattern of drinking water standard violations or significant groundwater quality degradation. However, data from several sources indicates that some nitrate contamination may be occurring (Fick, 2007).

Potential impacts resulting from lack of adequate control methods to prevent hazardous waste spills of fluids from getting into public wells are of concern. These spills could come from fuel deliveries to service stations (Map 6) or from other hazardous materials being transported through the BMPO on Highway 97, surface streets or on the railroad. A review of Map 4 shows the locations of drywells and catchbasins, which number in the thousands and conveys surface water underground. Work is underway to avoid this problem, but currently, if a spill occurs it will have a high likelihood of entering the groundwater and potentially wellhead protection areas. The 3rd street underpass is of particular concern because it is located in a municipal drinking water protection area. A rail car derailment at one of these overpasses (located at 3rd Street, Franklin or Greenwood) could result in a spill that could quickly drain underground and threaten groundwater. Cleanup would be difficult and expensive (Fick, 2007). More on this issue is covered in the next section on Stormwater.

Stormwater

For the past 100 years, sewage, industrial and commercial waste water and stormwater has been discharged underground to shallow aquifers that underlie the BMPO area. This is beginning to change but some of these practices continue today. There has been very little monitoring of the shallower aquifers to determine if they are being contaminated. According to the City of Bend, stormwater injected underground may be posing a threat to the quality of groundwater (City of Bend, 2007).

Currently stormwater is collected and discharged into the Deschutes River, or underground via drywells and drill holes (Map 4). In most cases there is no pretreatment of stormwater prior to discharge. According to City of Bend Public Works Department, the City's stormwater system includes about 13 miles of storm sewers, approximately 20 river outfalls, 3,280 drywells, 1,020 drill holes, and 5,200 catch basins along with a few infiltration ponds, swales, and manufactured treatment devices. The drywells and drill holes are designed to inject stormwater underground. In addition the Department reports that, "The City does not have the flow control facilities necessary for good flood and water quality management" (Stormwater Master Plan Project Fact Sheet, 2007).

Flooding is a frequent and serious problem in the City of Bend, with 30 problem areas identified. Five areas have been identified as the City's top priority to address (Map 5). In many locations throughout the city, systems are not capable of collecting, conveying and disposing of enough stormwater to prevent localized flooding even for 2-year storm events. For larger events, such as severe summer thunderstorms or heavy rainfall on a winter snow pack, flooding is serious enough to cause public safety problems, flood

property and cause land instability. In some areas, the city pumps storm runoff to the sanitary sewer system for a few hours until runoff subsides. This can hydraulically overload the sewage treatment plant and cause operating problems.

Snowmelt and rain-on-snow are serious winter problems for the city. Snow and ice plug drainage inlets and snow that is plowed onto sidewalks and other available areas throughout the city adds to the drainage problems when the snow melts, especially during rain-on-snow events. Also, the city applies cinders to many of its roads during the winter. Although it attempts to sweep these up before they can be washed into drainage systems, the city has problems with the cinders clogging its underground injection systems. Other than catch basins, few drainage systems include sediment removal devices or any other type of pretreatment.” Where the railroad passes over 3rd, Franklin, and Greenwood Streets are of particular concern for flooding. The streets below these overpasses are drained underground. These drainage systems frequently fail, causing stormwater to accumulate and block traffic.

The City is currently working on several plans to address water quantity and quality issues and comply with federal and state regulations. The City has adopted an Integrated Stormwater Management Plan which is required by the two permits held by the city: one to regulate discharges to the Deschutes River (National Pollutant Discharge Elimination System (NPDES) Phase II) and another for underground discharges. These regulations and permits require the city to use best management practices to improve stormwater quality.

A Stormwater Master Plan was adopted by the City of Bend in August 2014. The Stormwater Master Plan serves as the oversight plan for addressing stormwater quantity and quality issues. In addition to providing an overall strategy for addressing stormwater concerns, the plan provides a delineation of drainage areas and runoff quantities throughout Bend, and programmatic goals for addressing quantity and quality concerns.

Water Quality

Water quality problems in the Deschutes River result primarily from untreated stormwater discharges, impoundments, and summer low-flows due to irrigation diversions. Within the BMPO, the Deschutes River is currently listed on the Oregon Department of Environmental Quality 303(d) list because portions of the river do not meet state water quality criteria for temperature, pH, dissolved oxygen, turbidity, sedimentation and chlorophyll-a (Table 18-1). The Upper Deschutes Watershed Council monitors Deschutes River water quality for the city to provide data on the presence or absence of stormwater pollutants and to help the City of Bend comply with Clean Water Act regulations.

Because the Deschutes River is 303(d) listed for impaired water quality, the Oregon Department of Environmental Quality (DEQ) is required by the U.S. Environmental Protection Agency to develop Total Maximum Daily Load (TMDL) plans demonstrating what needs to happen in order for the Deschutes River to meet water quality standards.

As part of this process, DEQ will identify organizations or agencies that have legal authority over a sector or source that could be contributing pollutants. These entities will be identified as Designated Management Agencies (DMAs) and will be required to develop a plan identifying specific management strategies that will be implemented to help meet water quality standards. Because the Deschutes River flows through the Urban Growth Boundary, the City of Bend will likely be identified as a DMA by DEQ once TMDLs have been completed. DEQ is currently developing TMDLs for the rivers and streams in the Upper Deschutes.

DEQ has been monitoring Mirror Pond since 1958 at River Mile 164.9. The results are used to indicate general trends in river quality. Results from the data gathered from 2004 to 2013 rate Mirror Pond as “Excellent” in comparison to other rivers in the state, with the trend in water quality remaining consistent.

Tumalo Creek is listed on the DEQ 303(d) list because portions of the creek do not meet state water quality criteria for temperature. Water quality concerns in Tumalo Creek are concentrated in the reach below the Tumalo Feed Canal diversion. Stream flow and water quality within Tumalo Creek are critically important for the health of the middle Deschutes River because Tumalo Creek is the only tributary along 36 miles of the Deschutes River between the City of Bend and Whychus Creek. Therefore, improved streamflow and water quality in Tumalo Creek will improve stream flow and water quality in the middle Deschutes River.

Table 18-1: 303d Listings (2004/2006) in the vicinity of the BMPO Project Area

Water Body	River Miles	Parameter	Season	Criteria
Deschutes River*	168.2 to 189.4	Chlorophyll a	Summer	0.015 mg/l
	116.0 to 222.2	Dissolved Oxygen	January 1 - May 15	Spawning : Not less than 11.0 mg/L or 95% of saturation
	126.4 to 162.6	pH	Fall/Winter/Spring	pH: 6.5 to 8.5
	126.4 to 168.2	pH	Summer	pH: 6.5 to 8.5
	168.2 to 222.2	Sedimentation	Undefined	Narrative**
	110.8 to 223.3	Temperature	Year Around (Non-spawning)	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum
	168.2 to 222.2	Turbidity	Spring/Summer	10% increase Nephelometric Turbidity Units
Tumalo Creek	0.0 to 12.5	Temperature	Year Around (Non-spawning)	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum

* For the Deschutes River, the following descriptions indicate where each of the river mile (RM) breaks are approximately located: RM 116 – Lake Billy Chinook; RM 126.4 – Steelhead Falls; RM 162.6 – North Unit Canal diversion below Bend; RM 168.2 – Central Oregon Canal diversion above Bend; RM 189.4 – Little Deschutes River; RM 222.2 – Wickiup Dam.

**The formation of appreciable bottom or sludge deposits or the formation of any organic or inorganic deposits deleterious to fish or other aquatic life or injurious to public health, recreation, or industry may not be allowed.

Summer high flows at the southern BMPO boundary reach 2,100 cubic feet per second (cfs) while at the northern BMPO boundary flows are reduced to as low as 30 cfs by irrigation withdrawals. This dramatic reduction in flow has been determined to result in a variety of water quality impacts (Jones, 2003). One of the most important effects of this flow modification has been the increased rate of streambank erosion upstream of the BMPO. Once sediment from these eroding streambanks enters the Deschutes River, it is carried downstream to Bend where the sediment deposits behind impoundments. The sedimentation has caused impacts to aesthetics and recreational uses, and provides a substrate for algal and aquatic plant growth. It appears that these impoundments are contributing to increased temperature and increased primary productivity (i.e., algal growth) that are linked to water quality concerns.

Underground Tanks

According to the Oregon Department of Environmental Quality's database for Leaky Underground Storage Tanks (LUST) there is only one active site in Bend (leaky diesel tank). Leaking tanks can pose a water quality concern.

Recommendations

To avoid or mitigate potential impacts to water quality it is recommended that the that the best management practices in the Integrated Stormwater Management Plan and the Stormwater Master Plan be employed when building or retrofitting transportation projects.

Future Work to be Completed

- Identify all service stations and define specific transportation routes for fuel delivery. Prioritize stormwater management along those routes.
- Identify and define specific transportation routes for transportation of hazardous materials. Prioritize stormwater management along those routes.
- Map the remaining 25 drainage areas of concern for flooding on Map 5, Water Quality.

Fish, Wildlife & Habitat Resources

Summary

The Fish, Wildlife and Habitat Resources section of this chapter focuses on the special status or otherwise protected species of fish, wildlife, plants, and critical habitat in the BMPO. Data were gathered from a wide variety of sources including the Oregon Department of Fish and Wildlife, U.S. Fish and Wildlife Service, the Oregon Department of Environmental Quality, the Upper Deschutes Watershed Council and others. Documents reviewed include sub basin assessments, species listings, conservation strategies, regulations on protected lands, recovery plans and more. Three maps pertain to the section. They are Map 8 – Fish Passage; Map 9 – Natural Resource Protection Areas; and Map 10 – Vegetation. This section should be reviewed along with the sections and maps on Water Resources and Scenic Resources because the issues discussed in that section are closely related.

There are relatively few special status fish, wildlife or habitat resources in the BMPO compared with MPO areas west of the Cascades. Historically anadromous fish have not occurred in the area due to natural barriers. Oregon spotted frog and bull trout are federally listed species that may occur in the area, although bull trout have not been observed in the upper Deschutes above Steelhead Falls since the mid-1950's. There are only two naturally occurring bodies of water in the BMPO providing habitat for sensitive riparian and wetland species. However, there are many non-threatened wildlife species seen regularly along the Deschutes River and Tumalo Creek including river otter, beaver, muskrat, mink, osprey, heron, eagle, deer and elk. Water quality may impact fish and wildlife including via temperature, sedimentation, summer low flows below the North Canal Dam, and low winter flows upstream of the dam. Fish passage barriers are numerous. Transportation routes may impede wildlife movement, especially migrating deer and elk herds. Habitat loss has been significant as new

housing developments fill in the BMPO. Avoiding impacts to fish and wildlife and conserving habitat is the highest priority. Recommendations include improving fish passage, water quality and quantity, and habitat restoration.

Methodology

The following agencies were the primary resources for this section although other agencies, organizations and individuals were contacted.

- City of Bend
- Deschutes County
- Oregon Department of Agriculture
- Oregon Department of Fish and Wildlife
- Oregon Department of Transportation
- Oregon Natural Heritage Program
- U.S. Department of Interior, Fish and Wildlife Service

The following were the primary documents reviewed for this section:

Title	Source	Date
City of Bend General Plan and Zoning Code	City of Bend	1998, 2006
Deschutes County Comprehensive Plan and Zoning Code	Deschutes County	2005, 2001
Deschutes Subbasin Plan	Columbia River Basin Fish and Wildlife Program	June 2005
Bull Trout Recovery Plan - Chapter 7 Deschutes Recovery Unit	U.S. Fish and Wildlife Service, Region 1	2002
Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Bull Trout; Final Rule	Department of Interior	Sept. 26, 2005
Endangered and Threatened Wildlife and Plants; Removing the Bald Eagle in the Lower 48 States From the List of Endangered and Threatened Wildlife; Final Rule; Endangered and Threatened Wildlife and Plants; Draft Post-Delisting and Monitoring Plan for the Bald Eagle (<i>Haliaeetus leucocephalus</i>) and Proposed Information Collection; Notice	Department of Interior	July 9, 2007
Federally Listed Threatened, Endangered, Proposed, Candidate Species and Species of Concern Which may occur within Deschutes County, Oregon.	U.S. Fish and Wildlife Service	Based on listing date
Fish and Wildlife Habitat Mitigation Policy	Oregon Administrative Rules	
Noxious Weed List	Deschutes County	
The Oregon Conservation Strategy	Oregon Department of Fish and Wildlife	Feb. 2006
Oregon Natural Heritage - Invertebrates Listing	Oregon Biodiversity Information Center	

Oregon Natural Heritage - NonVascular Plants/Fungi List	Oregon Biodiversity Information Center	
Oregon Natural Heritage - Vertebrate List	Oregon Biodiversity Information Center	
Oregon Natural Heritage Plan	Oregon Natural Heritage Program	2003
Oregon Wildlife Movement Strategies - Focal Species	Oregon Department of Fish and Wildlife	Jan 26, 2007
Rare, Threatened, Endangered Species of Oregon 2004	Oregon Natural Heritage Information Center	May 2004
Redband Trout Status Report	Oregon Department of Fish and Wildlife	Not available
Riparian and Wetland Vegetation of Central and Eastern Oregon	Crowe, E.A., Kovalichik, B.L., and M.J. Kerr	June 2005
Status Review Update for Deferred ESU of West Coast Chinook Salmon	West Coast Chinook Salmon Biological Review Team	July 16, 1999
The Bend Riverway, A Community Vision	Bend Park and Recreation Foundation	July 1999
Upper Deschutes Subbasin Assessment	Upper Deschutes Watershed Council	Aug 2003
USFWS Threatened and Endangered Species Systems (TESS)	U.S. Fish and Wildlife Service	Website
Upper Deschutes River Subbasin Fish Management Plan	Oregon Department of Fish and Wildlife	Oct 1996
Section 4(f) of the Department of Transportation Act	Department of Transportation	1966

Digital data layers were combined to create maps depicting environmental information available in 2007. The following are the map titles along with the data layers shown and the source of the data. For details on the metadata see Appendix F.

Map #	Map Title	Data Layer	Data Source
8	Fish Passage	Bridges	Deschutes County
		Dams, Diversions	City of Bend
		Salmonid Habitat	Oregon Department of Fish and Wildlife
9	Natural Resource Protection Areas	Bend Local Wetland Inventory	City of Bend
		City River Areas of Special Interest	City of Bend
		City Upland Areas of Special Interest	City of Bend
		City Waterway Overlay Zone	City of Bend
		County Open Space & Conservation Zone	City of Bend
		County Wildlife Area Combining Zone (Elk & Deer)	Deschutes County
		National Wetland Inventory	Deschutes County
		Rivers	Deschutes County
		Streams	Deschutes County

		Eagle Nest Vicinity	Oregon Department of Fish and Wildlife
10	Vegetation	Vegetation	Deschutes County

Findings

The Oregon Department of Fish and Wildlife have identified six conservation issues in their Oregon Conservation Strategy. They include:

- Land use changes
- Invasive species
- Changes in flood or fire regimes
- Water quality or quantity
- Institutional barriers
- Barriers to fish and wildlife movement

Transportation projects can impact several of these conservation issues through design, construction and implementation.

Habitat

The Deschutes River and Tumalo Creek provide the only riparian habitat in the BMPO. Much of the riparian corridor is relatively undisturbed to the north and south of the main urban core. There are no wetlands in the BMPO other than those associated with the riparian areas along the Deschutes River. Several of the riparian wetland areas are created artificially by water impoundments. There are a number of areas identified by the National Wetlands Inventory outside the Bend city limits in Deschutes County, but are probably artifacts of mapping and groundtruthing is recommended. Open space, forests and desert, cliffs, caves, and lava tubes, large old ponderosa provide habitat in the uplands. Impacts to habitat include habitat loss and fragmentation from new development and roads. Instream habitat can be impacted by water quality.

Mixed conifer and ponderosa pine communities are common in the western portion of the BMPO while sagebrush, juniper, and sparse ponderosa pine communities occur on the eastern side. Riparian vegetation is dominated by willow, alder and sedges (Map 10) (ODFW, 1996).

There are no state or federal waterfowl or wildlife refuges in the BMPO and therefore no wildlife refuges that are protected by Section 4(f) of the U.S. Department of Transportation Act of 1966.

Fish

There are no anadromous fish species in the Deschutes River above Big Falls at river mile 132, downstream of the BMPO. Big Falls is a barrier to summer steelhead, Chinook salmon, and Pacific lamprey which were historically present up to Big Falls (Map 8).

Bull trout (*Salvelinus confluentus*) is federally listed as threatened (Appendix F). The redband trout (*Oncorhynchus mykiss*) is present in the BMPO and is a federal species of concern. Alteration of the natural river flow regime is caused by irrigation diversions, and the associated effects to aquatic and terrestrial habitat resulted in the extirpation of bull trout and appreciably reduced the redband trout population (Columbia River Basin Fish and Wildlife Program, 2005.)

Historically, bull trout, redband trout, sculpin and whitefish were the indigenous salmonids in this segment of the Deschutes River. Wild fish species currently present are redband trout and mountain whitefish. The Pelton Roundbutte dam complex in 1968 restricted the navigation of salmon and steelhead. The Confederated Tribes of the Warm Springs, Portland General Electric, and many State agencies, Federal agencies, and non-governmental organizations completed a new fish passage system that allows salmon and steelhead to migrate past three Deschutes River dams. This fish passage system will help restore the historical species assemblage in the lower Deschutes (USFWS, 2002). Over \$60 million dollars was being spent to bring salmon and steelhead back into the Deschutes and other tributaries below Big Falls (PGE website). The project was completed in 2008 and smolts were reintroduced to Whychus Creek. While the fish will not be able to reach the Deschutes River above Big Falls or Tumalo Creek, the water quality in the BMPO area could affect the downstream fishery.

Bull Trout

In 1998, the U.S. Fish and Wildlife Service listed the Columbia River population of bull trout (*Salvelinus confluentus*) as a threatened species under the Endangered Species Act. Historically, the upper Deschutes provided suitable and plentiful habitat for widespread bull trout populations and they were distributed throughout the Deschutes River basin from the headwaters in the Cascades to the Columbia River. At the time of listing bull trout had been extirpated from their historical habitats in the upper Deschutes above Big Falls (River Mile 132). Critical habitat for Bull Trout has been established in northern Deschutes County, outside the BMPO boundary.

According to the Recovery Plan, the main land and water management activities that depress bull trout populations and degrade habitat include fish passage associated with dams and diversions, and water quantity and quality issues associated with stormwater. Impassable dams and diversion structures isolate and fragment bull trout local populations and adversely impact water quality and quantity. Low flows and seasonally high temperatures probably reduced the river's suitability for bull trout foraging and rearing.

Redband Trout

The redband trout is indigenous to the upper Deschutes subbasin. Redband trout are a subspecies of rainbow trout and steelhead, and are adapted to the arid conditions east of the Cascades. Redband trout spawn in rivers and streams during the spring and require cool, clean, well-oxygenated water for the eggs to survive. Historically, they were found throughout the Upper Deschutes subbasin in waters connected to the Deschutes River and in Tumalo Creek (ODFW, 1996)

According to Oregon Department of Fish and Wildlife's Fish Management Plan, redband distribution in the subbasin today is "fragmented due to dams without fish passage, natural barriers, severe stream flow alterations from irrigation development, chemical treatment projects, and introduction of non-indigenous trout stocks." Redband are found throughout the BMPO on both the Deschutes River and Tumalo Creek and the species is listed as a State Sensitive Species. The introduction of non-native fishes such as brook and brown trout, and habitat changes caused by logging, severe wildfire, grazing, irrigation, dam construction, and urban development have caused dramatic declines in the distribution and abundance of redband trout throughout its range. Low summer flows in the Deschutes downstream from North Canal Dam and warm water temperatures greatly reduce summer rearing areas (ODFW).

Tumalo Creek once provided spawning and rearing habitat for a core redband trout population that migrated from the Deschutes River. Currently, fish passage from the Deschutes River to potential spawning and refuge areas in Tumalo Creek is restricted at the Tumalo Feed Canal diversion but small populations of redband trout occur throughout the Tumalo drainage. Increased summer flows in the lower reach below Tumalo Feed Canal have improved summer water temperatures (Columbia River Basin Fish and Wildlife Program, 2005.)

Fish Passage

The fishery in the Deschutes River and Tumalo Creek was strong with a historic record showing that in 1906 four men fished for four days to harvest 3,400 fish for Bend's Fourth of July. Just a few years later, in 1912, the first hatcheries were built to support a failing fishery. By the early 1920's six irrigation diversions (one is just outside the BMPO's southern boundary) and four dams were in operation in the BMPO area (Map 8.) Most of the structures did not have adequate fish passage. There are a total of 10 identified fish passage barriers upstream of Steelhead Falls at River Mile 128 (Redband Trout Status Report.). Tables 18-2 and 18-3 list the dams and diversions within the BMPO.

Table 18-2: Dams Within the BMPO

Dam Name	Location / Pond Name	Built	Operator	Fish Ladder
Colorado Dam	Colorado Street Bridge / creates unnamed 5.5 acre wetland.	1916	River Bend Limited Partnership	Yes – but not effective. Installed in 1998.
Bend Hydroelectric Project	Just north of Newport Bridge / creates Mirror Pond.	1910	Pacific Power and Light	No. Historically there was a wooden fish ladder.
Steidl Dam	Above 1 st Street rapids / creates unnamed pond adjacent to Pioneer Park.	1922	Tumalo Irrigation Dist.	Yes.
North Canal Dam	South of Mt. Washington Blvd. / creates “Swan Pond” in front of Riverview Park.	1914	Jointly managed by COID & Swalley Irrigation Dist.	No. Dam is 33 feet high

Source: Bend Riverway 1999; updated via personal communication ODFW 2007

Table 18-3: Diversions within the BMPO

Diversion Name	Diversion Location	Fish Screen	Typical Summer Maximum Flows
Central Oregon Canal	East side of river ¼ mile north of River Rim development	Yes. Perforated plate screen. Fixed panel with self-cleaning brush. Black paint has camouflaged this screen.	550 cfs
Bend Feed Canal (Tumalo Irrigation Dist.)	West side of river at 1 st Street Rapids	Yes. New “state of the art” screen	140 cfs
Swalley Irrigation Canal*	East side of river at North Canal dam	Yes. Upgraded in 2005	115 cfs
North Canal or Pilot Butte Canal*	East side of river at North Canal dam	Yes. Upgraded in 2005	550 cfs
North Unit Main Canal*	East side of river at North Canal dam	Yes. Has a drum screen. Will be upgraded.	800 cfs

COID = Central Oregon Irrigation Dist. TID = Tumalo Irrigation Dist.,

ODFW = Oregon Dept. of Fish and Wildlife; cfs = cubic feet per second.

Source: Bend Riverway 1999; updated via personal communication ODFW 2007

*shown in same location on Fish Passage Map

Birds

The bald eagle (*Haliaeetus leucocephalus*) was removed as a federally threatened species in 2007. The [final delisting rule](#) was published in the Federal Register on July 9, 2007 and became effective 30 days later. The bald eagle is protected under the Bald

and Golden Eagle Protection Act and Migratory Bird Treaty Act. Bald eagles are commonly seen in the BMPO. There is a nest just outside the western boundary of the BMPO (Map 9).

The Northern Spotted Owl (*Strix occidentalis caurina*) is a federally threatened, as is its critical habitat. There is no critical habitat for Northern Spotted Owl in the BMPO.

The yellow-billed cuckoo (*Coccyzus americanus*) is Federally proposed as threatened and has only been seen incidentally in the BMPO. The only known sighting was about 17 years ago (Marx, 2007).

A number of birds are listed as federal Species of Concern (Appendix F) but only the olive-sided flycatcher, willow flycatcher, yellow-breasted chat and Lewis' woodpecker are expected in the BMPO area. The white-headed woodpecker, northern goshawk and ferruginous hawk may pass through the area on occasion. There is no known habitat in the BMPO for greater sage-grouse, a species being considered for listing (Carey, 2007).

Impacts to birds include habitat loss and fragmentation, vehicle movement and other human-caused disturbances.

Mammals

The Gray Wolf (*Canis lupus*) is the only federally listed mammal that may occur in Deschutes County, but it is very unlikely to be found in the BMPO (Appendix F). It is listed as an endangered species.

One candidate species, the Pacific fisher (*Martes pennanti pacifica*) may occur in the County but it is also unlikely to be found in the BMPO.

No extensive bat surveys have been conducted that cover the BMPO area, but several bats reported as rare and threatened by the Oregon Biodiversity Information Center are known to migrate through and/or nest in the area. There is bat habitat within the BMPO. Lava tubes, caves and bats are specifically mentioned in the Steven's Road Tract master plan on the east side of the BMPO. Other caves, rim rock cliffs, trees and bridges may also provide bat habitat. Impacts to bats may result from habitat loss and insecticide use.

Deer and elk winter range surround the BMPO, primarily to the west and south. There is significant deer migration from the Deschutes National Forest west of the Deschutes River to wintering ranges east of the river identified as the North Paulina, Devil's Garden and Hole in the Ground Ranges (Deschutes County, 2005). Approximately 30,000 to 35,000 mule deer migrate twice a year through and around the BMPO. Elk are commonly found within the BMPO near the southern BMPO boundary. Seasonal wildlife migration and year around movement of elk and deer is a serious concern for the safety and well being of both the animals and people.

Wildlife Movement

Roads pose several concerns including habitat fragmentation and crossing concerns for wildlife, and property damage to cars and personal injury to humans.

As traffic volumes increase, so do the numbers of wildlife crossing issues. In 2012, there were approximately 18,000 (at Pinebrook Boulevard) to 42,000 (at Empire Avenue) vehicles passing through the BMPO on Highway 97 daily and another 14,000 (at 27th Street) to 16,000 (near 3rd Street) vehicles traveling on Highway 20. Approximately 1,250 animals were killed on roadways in Deschutes County in 2006 (Bryant, 2007). Highway 97 has been identified as barrier between summer and winter deer and elk range with 400 deer killed annually in a 50-mile stretch of highway. The deer and elk migrate using a “sheet migration,” crossing almost anywhere. In 2006, wildlife encounters with cars were spread fairly evenly up and down the highways. The Oregon Department of Fish and Wildlife has compiled a focal species list for wildlife movement that includes amphibians and reptiles in additions to mammals.

Amphibians and Reptiles

Oregon spotted frog (*Rana pretiosa*) is a federally listed threatened species in Deschutes County. The Cascades frog (*Rana cascadae*) and northern sage lizard (*Sceloporus graciosus graciosus*) are listed as Species of Concern. There are other amphibians and reptiles listed federally for the County (Appendix F) but they are not likely found in the BMPO area. Cascade frog is most commonly found at higher elevations and the spotted frog is typically found farther south, including within the BMPO boundary. Proposed critical habitat for the Oregon spotted frog is within the BMPO – extending along the Deschutes River from the western BMPO boundary to the Colorado Avenue bridge.

Impacts to amphibians and reptiles may occur through habitat loss and fragmentation, invasive species infestations, and water quality degradation.

Invertebrates

There are no federally listed invertebrates in Deschutes County. Invertebrates have been reported by the Oregon Biodiversity Information Center for Deschutes County (Appendix F).

Non-Vascular Plants and Fungi

There are no federally listed non-vascular plants or fungi in Deschutes County. There are, however, numerous liverworts, mosses, lichens and fungi listed by the Oregon Biodiversity Information Center (Appendix F). Impacts to these species can include habitat loss, water and air quality.

Invasive species

The bullfrog (*Rana catesbeiana*), an invasive non-native species is found in the area. Other invasive species such as quagga mussel (*Dreissena bugensis*), zebra mussel (*Dreissena polymorpha*) and fox squirrel (*Sciurus niger*) have not made their way to the BMPO area but their arrival is anticipated. Invasive mollusk species are transported

from one area to another on boats and boat trailers towed from an infested area. In 2007, the BMPO was sprayed for gypsy moth (*Lymantria dispar*). Other non-native invasive insects are present or anticipated to arrive in the coming years. Invasive species common on the west side of Oregon such as nutria and opossum have not been reported in the BMPO area – most likely due to the cold winters. This could change as global climate change affects the seasonal weather.

Plants

A number of vascular plants are listed as federal Species of Concern in Deschutes County (Appendix F). It is unlikely that any of these plants are found within the BMPO (because of their habitat requirements) but as with many plant species, unexpected disjunct occurrences are often found when surveys are conducted (Gilbert, 2007).

There are numerous plants listed by the Oregon Biodiversity Information Center for Deschutes County (Appendix F.) Impacts to plants are primarily from habitat loss through development and from competition by invasive species.

Noxious Weeds

The Deschutes County Board of Commissioners has designated 58 noxious weed species in the County (Appendix F), as of April 2014. A noxious weed is one that is “injurious to public health, agriculture, range, recreation, wildlife, or any public or private property; any weed that impacts and displaces desirable vegetation, such as Threatened and Endangered Plant Species, wildlife habitat, and livestock” (Deschutes County Noxious Weed List). The weeds are ranked A (29 species), B (13 species), and C (16 species) depending on control goals set by the County. Some of the most common include the knapweeds, toadflax, and yellow flag iris. Transportation corridors are a common way to spread noxious species.

Protected Areas

The City of Bend has a number of codes designed to protect natural features and resources. Each of these protected areas is shown on Map 9 and is described below.

City of Bend protects water resources under Chapter 2.7.600 of the City Code in a zone called the Waterway Overlay Zone (WOZ). The code states “The Deschutes River and Tumalo Creek stream corridors within the urban growth boundary of the City of Bend are valuable economic, recreational, scenic and natural resources for the community. The WOZ is intended to conserve and enhance the natural resource values of areas along the Deschutes River and Tumalo Creek within the city.”

The WOZ includes the following sub-zones, which provide various types of protection:

- Riparian Corridor – defines minimum setbacks from Deschutes River and Tumalo Creek and significant wetlands.
- Deschutes River Corridor Design Review – design review for building within 100 feet of the river; criteria and process to determine setbacks.
- River Corridor Areas of Special Interest – unique areas (primarily rimrock and canyons) with protection criteria.
- Flood Plain – criteria and process for development in the floodplain.

The City has a Local Wetlands Inventory, however there are only a few significant wetlands in the BMPO and all of them are located in the riparian corridor of the Deschutes River. There are a number of areas identified as wetlands by the National Wetlands Inventory, but these should be ground truthed as they may be mapping artifacts.

The City of Bend also protects special features in a zone called “Upland Areas of Special Interest Overlay Zone” that is intended to protect valuable natural resources. The zone is described in Chapter 2.7.700 of the City Code as “scattered rock outcrops, stands of trees, and dominant ridges and faults that are typical of the Central Oregon landscape. These areas contain high points or changes in elevation that break the line of sight so that the area retains a feeling of undeveloped open space.” The zone defines setbacks and allowed uses of these areas, many of which are on private property.

Deschutes County also has several zones and regulations to protect natural features including the Wildlife Combining Zone and the Open Space Conservation Zone. The County adopted the National Wetlands Inventory to comply with Goal 5.

The purpose of the Open Space and Conservation Zone (Chapter 18.48 of the Deschutes County Code) is to protect designated areas of scenic and natural resources; to restrict development in areas with fragile, unusual or unique qualities; to protect and improve the quality of the air, water and land resources and to plan development that will conserve open space.

The purpose of the Wildlife Area Combining Zone (Chapter 18.88) is to “conserve important wildlife areas in Deschutes County; to protect an important environmental, social and economic element of the area; and to permit development compatible with the protection of the wildlife resource.” This zone provides protection for migrating elk and deer primarily through the type and density of allowed uses. This zone is shown on Map 9 with the animal species and herd names. The zone is only in the County jurisdiction and stops at the Bend city limits. It should be noted that the animals do not stop at jurisdictional boundaries.

State and Federal Wild and Scenic Rivers are also protected. Please see the section Scenic Resources in this chapter for more information.

Recommendations

Habitat

Design transportation projects to avoid and minimize the impacts to habitat wherever possible. See general policies for more.

Bull trout, redband trout, and Oregon Spotted frog

Identify and explore methods to protect, restore, and maintain suitable habitat conditions for bull trout, redband trout, and Oregon spotted frog for all transportation

projects, especially those near the Deschutes River or Tumalo Creek, including the following:

- Maintain or improve water quality.
- Stabilize roads, crossings, and other sources of sediment delivery.
- Identify barriers or sites of entrainment and implement tasks to provide passage and eliminate entrainment.
- Screen water diversions and irrigation ditches.
- Restore connectivity and opportunities for migration by securing instream flows and/or water rights.

Invasive species

- Develop measures that prevent invasive species from entering the area on cars, trucks, boats, boat trailers or other vehicles.
- Design transportation projects to prevent the spread of noxious weed species.

Wildlife Linkages

The design of new transportation projects and the retrofit of existing projects shall include the identification of any wildlife movement issues and a review of best management practices to facilitate wildlife movement to improve human and wildlife safety, decrease habitat fragmentation and property damage. Include mapped wildlife movement areas of concern.

Future Work to be Completed

There may be additional activities recommended for specific species including bats that should be identified.

Hazards

Summary

The Hazards section of this chapter focuses on issues related to natural hazards such as earthquake fault lines, floodplains, wildfire areas and surface mines. It includes information on soils, topography and steep slopes. Data were collected from a wide variety of sources including the Federal Emergency Management Agency, Environmental Protection Agency, National Resources Conservation Service, Oregon Department of Environmental Quality and the City of Bend. There are two maps that relate to this section: Map 11: Natural Hazards and Map 12: Soil Conductivity. This section should be reviewed along with the section on Air Quality and also Water Resources, particularly the stormwater data as they are closely linked. There were no identified hazardous waste issues or areas including toxic releases to the air. Existing code addresses potential issues with earthquakes, flooding and landslides. Recommendations are made to ensure consideration of emergency evacuation routes, stream channel movement and potential issues with the railroad.

Methodology

The following agencies were the primary resources for this section although other agencies, organizations and individuals may also have been contacted.

- City of Bend
- Deschutes County
- Environmental Protection Agency
- Federal Emergency Management Agency
- Natural Resources Conservation Service

The following were the primary documents reviewed for this section:

Title	Source	Date
Emergency Operations Plan	Deschutes County Sheriff's Office	November 2003
Deschutes County Code	Deschutes County	2001
Bend City Code	Bend City Code	2006
Preliminary Risk Assessment for Creosote	Environmental Protection Agency	
Critical Areas Ordinance; Best Available Science Volume 1; Chapter 4: Channel Migration Zones	King County Washington	

Digital data layers were combined to create maps depicting environmental information available in 2007. The following are the map titles along with the data layers shown and the source of the data focusing on environmental hazards. See Appendix F for details on the metadata.

Map #	Map Name	Data Title	Data Source
11	Natural Hazards	Earthquake Fault Lines	Deschutes County
		FEMA 100 Year Flood	Deschutes County
		Historic Fires	Deschutes County
		Steep slopes >25%	Deschutes County
		Surface Mine Impact Area	Deschutes County
		Surface Mines	Deschutes County Deschutes County
		Topography 100 Foot Contours	Deschutes County
		Topography 50-100 Foot Contours	Deschutes County
12	Soil Conductivity	Soil conductivity (permeability)	USDA

See also these maps: Stormwater, Environmental Health and Water Quality, discussed in the Water Resources section of this report.

Findings

The Environmental Protection Agency website was reviewed but no active sites were located in the BMPO on the Toxic Release Inventory or the superfund site (see also Air Quality.)

Wildfire evacuation routes are important to public safety. Transportation projects could conflict with public safety if evacuation routes are not considered. The Natural Hazard

Map (no. 11), shows wildfires that have occurred in the past. More than 20 homes were destroyed in the Awbrey Hall fire in 1990.

Flooding of the Deschutes River occurs very rarely because the river is highly regulated by dams. Flooding occurs when ice dams build up in the winter then break, releasing water. The last flood was in the early 1980's. An ice boom is installed in the river in the winter to prevent the formation of ice dams. Tumalo Creek floods in the spring. The reach of the creek that floods is in Shevlin Park where it is allowed to spill over its banks and it has changed course over the years. Flooding and channel migration may be an issue for transportation projects near the creek. Impacts to the creek and to property can be avoided if they are assessed early on and the project is designed to minimize conflict. The Federal Emergency Management Administration floodplains are shown on Map 11.

Several proposed transportation projects cross earthquake fault lines (Map 11). They are also crossing areas of low soil conductivity (Map 12). This could contribute to stormwater problems (see Water Resources.) Landslides are not common in the BMPO.

Surface Mine Impact Areas are also identified (Map 11) and regulations restrict noise and dust-sensitive uses in the area of a surface mine (Deschutes County Code 18.56.) The purpose of the zone is to protect the surface mining resources of Deschutes County from new development which conflicts with the removal and processing of a mineral and aggregate resource while allowing owners of property near a surface mining site reasonable use of their property. The zone applies to all property located within one-half mile of the boundary of a surface mining zone. This is not anticipated to have any conflicts with proposed transportation projects.

The Burlington Northern Railroad bisects the BMPO in a north-south direction. Conflicts with transportation projects include increased cost of crossing a railroad or avoiding it and potential environmental concerns from toxics transported on the railroad. In addition the Environmental Protection Agency (EPA) is currently reassessing creosote (commonly used in railroad ties) as part of its ongoing re-registration program for older pesticides. The EPA website has a fact sheet with recommended safety precautions advised for the use, removal and disposal of railroad ties.

Recommendations

- Consideration of wildfire hazards and other emergency evacuation routes should be taken into account in the design of transportation projects.
- Further investigation of the issues involved with railroad transport should be conducted, specifically the potential for toxic releases and railroad maintenance.
- Transportation projects near Tumalo Creek should analyze potential flooding impacts and channel migration potential and develop mitigation if impacts are identified.

Climate Change

Summary

The Climate Change section of this chapter focuses on issues relating to predicted changes in the climate in the BMPO area from global warming. Data were gathered from the Oregon Climate Service, Climate Impacts Group, the Governor's Advisory Group on Global Warming and the Oregon Department of Environmental Quality. There are no maps that relate to this section. This section should be reviewed along with the section on Air Quality as they are closely linked. Impacts from transportation include greenhouse gas emissions. Greenhouse gases result primarily from the burning of fossil fuels in vehicles. Mitigations have been identified to reduce greenhouse gasses through the design of transportation projects and the adoption of greenhouse gas reducing tactics. Recommendations include adopting the some key actions identified in the *Oregon Strategy for Greenhouse Gas Reduction*.

Methodology

The following agencies were the primary resources for this section although other agencies, organizations and individuals may also have been contacted.

- Oregon Department of Environmental Quality
- Climate Impacts Group
- Governor's Advisory Group on Global Warming
- Oregon Climate Service

The following were the primary documents reviewed for this section:

Title	Source	Date
2013 Air Quality Data Summaries	DEQ	June 2014
Oregon Strategy for Greenhouse Gas Reduction	Governor's Advisory Group on Global Warming	Dec. 2004 revised
Oregon Climate Service website	Oregon Climate Service	
Climate Impact Group website	Climate Impact Group	
OAR 660-044 (Metropolitan Greenhouse Gas Reduction Targets)	http://www.oregon.gov/LCD/CLIMATECHANGE/pages/metropolitan_greenhouse_gas_reduction_targets.aspx	

No maps were made for this section.

Findings

The Oregon Climate Service includes the BMPO in the South Central Oregon climatic division, which extends from Sisters in the west, Fossil in the north, Malheur in the east and Klamath Falls to the south. The area is described a "vast area of high desert prairie punctuated by a number of mountain ranges and isolated peaks." Most of this region receives relatively low amounts of precipitation with areas near the Cascades including the BMPO area tending to have annual distributions very similar to those in western Oregon: winter precipitation followed by a steady decrease, with lowest monthly

averages in midsummer. The months of July through September are generally the driest of the year throughout the region and often have isolated local thunderstorms. Some months are very wet and others almost completely dry” (Oregon Climate Service website).

Oregon’s environment is already being impacted by global climate change. All of our glaciers are receding, some by as much as 60%. Snow pack is down, making it increasingly difficult to find enough water to irrigate farms and maintain adequate flows for fish.

According to the Climate Impact Group’s website the climate of the Pacific Northwest has changed during the past 100 years in a number of ways including:

- Region-wide warming of about 1.5°F (0.8°C) in 100 years.
- Increase in precipitation in most of the region.
- Decline in snowpack – especially at lower elevations – since 1950.
- Spring is arriving earlier in the western U.S.

The website further states, “In a future, warmer world, warmer temperatures will result in more winter precipitation falling as rain rather than snow throughout much of the Pacific Northwest, particularly in mid-elevation basins where average winter temperatures are near freezing. This change will result in:

- less winter snow accumulation,
- higher winter streamflows,
- earlier spring snowmelt,
- earlier peak spring streamflow, and
- lower summer streamflows

Global climate models scaled to the Pacific Northwest project an increase in average regional temperatures of 0.5° per decade throughout the 21st century. Temperature increases are expected to occur across all seasons with the largest increases in summer. Changes in annual precipitation are less certain. Most of the models analyzed by the Climate Impact Group show decreases in summer precipitation and increases in winter precipitation with little change in the annual mean.

A declining snowpack could have a significant impact on water resource availability. Substantial reductions in summer streamflow are anticipated in the coming decades and will adversely affect many water users, including farmers who rely on irrigation, resident and anadromous fish, and summertime hydropower production.

If Central Oregon experiences a reduced snowpack or earlier snow melts, there would be a change in run-off patterns for the Little Deschutes River, a tributary of the Deschutes River upstream of the BMPO. Currently, its average peak run off month is May and June. This could be a month earlier in the future. It may also result in higher flows during the winter because of rain rather than snowfall. There may not be a

significant change in the flows of the Deschutes River because most of the run-off occurs through the absorption of snowmelt into the ground and emanating as spring flow later in the summer. For the most part, due to the porous nature of the soils in the Deschutes basin, precipitation in any form at any time of the year is mostly absorbed into the ground. Predicting changes in weather patterns, however, is very uncertain (Gorman, 2007).

Other climate change related impacts in the areas could include:

- Warmer water temperatures in rivers and stream affecting fisheries
- Increase in wild fires
- Change in the composition of forest species
- Increase in noxious non-native species of insect, plants and mammals
- Drought resulting in less water instream for irrigation and fish
- Extinction of local populations
- Loss of biological diversity

According to the Department of Energy “The impacts of such changes on Oregon citizens, businesses and environmental values are likely to be extensive and destructive. Coastal and river flooding, snowpack declines, lower summer riverflows, impacts to farm and forest productivity, energy cost increases, public health effects, and increased pressures on many fish and wildlife species are some of the effects anticipated by scientists at Oregon and Washington universities.”

The Oregon Strategy for Greenhouse Gas Reduction states that in 2000, 84% of greenhouse gas emissions in Oregon were Carbon dioxide (CO₂). The primary source of CO₂ emissions came from burning fossil fuels, such as coal (power plants), gasoline, diesel, and natural gas. There were also emissions from various industrial processes and emissions from municipal and industrial wastes incineration of fossil-fuel derived products.

One-third of Oregon’s greenhouse gas emissions are from transportation. Cars, light trucks, sport utility vehicles, buses, large trucks, airplanes, trains and marine vessels all contribute to these emission levels. There are over 3.1 million motor vehicles registered for roadway use in Oregon. Oregonians spend more than \$3 billion for transportation fuels each year. In 2011, the Land Conservation and Development Commission (LCDC) adopted per capita GHG emission reduction targets for light-duty vehicles for all six metropolitan areas within Oregon. The target for the Bend MPO is to reduce emissions 18% per person over 2005 levels by year 2035 (OAR 660-044).

In June 2014, the City of Bend received grant from the Oregon Department of Transportation to install a compressed natural gas (CNG) fueling facility. CNG offers lower greenhouse gas emissions than gasoline or diesel. The facility will provide CNG fueling for publicly-owned fleets and the general public. The facility is planned at the City of Bend’s public works facility at 575 NE 15th Street.

In July 2007, the City of Bend mayor signed the U.S. Conference of Mayors' Climate Protection Agreement. This agreement sets general goals for the city to reduce pollution, cut energy use and add more sustainable programs.

The BMPO and the City of Bend prepared a Public Transit Plan in 2013 to ensure that improvements necessary to accommodate future public transportation services are pre-located years in advance of implementation and become an integral part of the local planning process, which will promote transit service and support the reduction of greenhouse gas emissions.

Recommendations

Adopt the transportation actions identified in the Oregon Strategy for Greenhouse Gas Reduction that are appropriate for the BMPO.

Mitigations measures from the Oregon Strategy for Greenhouse Gas Reduction are designed to reduce greenhouse gas emissions from consumption of fossil fuels by displacing conventional combustion engines with hybrid, electric and other technological/fuel options, and to guide land use choices, especially in Oregon's urban areas, toward more efficient choices including higher densities, transit options, mixed-use neighborhoods, and common wall dwelling designs. Mitigations should be updated as new information becomes available. Among the recommended actions outlined in the report that may be appropriate for the BMPO are:

- Integrate land use and transportation decisions with greenhouse gas consequences.
- Promote alternative fuel use and production.
- Incorporate greenhouse gas emission impacts into transportation planning decisions.
- Promote better management and use of parking
- Support and implement demand management programs
- Encourage bicycling and walking for short trips
- Support development of carsharing programs
- Support development of more sustainable funding sources to support maintenance and operation of the transportation system
- Set up traffic engineering "Best Practices" (as applicable to the City of Bend's ongoing work on modifying traffic analysis requirements)
- Improve mass transit and inter-city transit links.

An overall recommendation is to work with the City of Bend to conduct a carbon inventory and consider crafting a comprehensive carbon emissions reduction plan.

Air Quality

Summary

This section focuses on air quality in the BMPO. Data were collected primarily from the Oregon Department of Environmental Quality (DEQ) and the U.S. Environmental Protection Agency. Documents reviewed include air emission reports, comprehensive

plans and air quality data. This section should be reviewed with the section on Climate Change and Hazards as they are closely related. Potential conflicts resulting from transportation projects to air quality include increases in carbon monoxide from vehicle emissions and dust from cinders (used for icy road conditions). The primary recommendation is to conduct further analysis of air quality impacts from proposed transportation projects.

Methodology

The following agencies were the primary resources for this section although other agencies, organizations and individuals may also have been contacted.

- U.S. Environmental Protection Agency
- Oregon Department of Environmental Quality

The following were the primary documents reviewed for this section:

Title	Source	Date
Air Emissions Inventory (PM 10 Emission Estimates)	Oregon Department of Environmental Quality	
PM 10 Emissions Estimates, Fugitive Dust Report	Oregon Department of Environmental Quality	June 2005
Deschutes County Comprehensive Plan	Deschutes County	2005
City of Bend General Plan	City of Bend	1998
Environmental Protection Agency TriExplorer website	Environmental Protection Agency	
2013 Air Quality Data Summaries	Oregon Department of Environmental Quality	June 2014

There are no maps for this section.

Findings

According to the 2013 Oregon Air Quality Data Summaries from the DEQ the air pollutants of greatest concern in Oregon are:

- ground-level ozone, commonly known as smog
- fine particulate matter (mostly from wood smoke, other combustion sources, cars and dust) known as PM2.5 (2.5 micrometers and smaller diameter)
- hazardous air pollutants (also called Air Toxics)

Motor vehicles are the primary source of air pollution in Oregon. Although each individual car or truck contributes relatively small amounts of pollution, the sheer number of vehicles makes their total contribution larger than any other single source. Emissions from cars contribute to ground level ozone pollution (smog) especially on hot summer days (DEQ, 2005).

Fine particulate air pollution consists of solid particles or liquid droplets that are less than 10 microns in diameter (PM10) or less than 2.5 microns in diameter (PM2.5). Particles in these size ranges are of great concern because they can be inhaled deeply

into the lungs where they can remain for years. The health effects of particulate matter vary with the size, concentration, and chemical composition of the particles (Oregon Department of Environmental Quality Website).

The Bend General Plan adopted in 1998 notes that in Bend, there are two air pollutants of concern that are monitored on a regular basis. They are carbon monoxide (CO) and very small particulate matter (PM10). Automobile exhaust and other incomplete combustion are typical sources of CO production. A variety of materials such as windblown dust, field and slash burning, wood stove smoke, and road cinders used for winter sanding can produce fine particles that fall into both the PM10 and PM2.5 air pollution category.

The plan further states that, “Although the few occurrences of exceeding these two air quality standards have *not* been of sufficient frequency to have Bend designated as an air quality “non-attainment area,” the forecast of significant population and economic growth for Bend and Deschutes County increases concerns about Bend’s ability to maintain compliance with the air quality standards” (Bend General Plan, 1998).

Other occurrences or activities affecting air quality in the BMPO include wood burning stoves, winter inversions, cinder particulates (spread on roads to reduce icy conditions) and outdoor burning. Field burning (primarily north of the BMPO) and wildfires also contribute to poor air quality.

The Air Quality Index (AQI) is based on data collected from the Oregon Department of Environmental Quality’s air monitors. These raw measurements are converted into AQI values. An AQI value is calculated for each individual pollutant using standard formulas. The highest of the AQI values for the individual pollutants becomes the AQI value for that day. For example, if AQI values were 90 for ozone and 88 for carbon monoxide, the AQI reported would be 90 for the pollutant ozone on that day (DEQ website). Bend has a monitor in Pioneer Park that monitors daily air quality. Table 18-4 shows the AQI for 2013 for the BMPO area.

Table 18-4: 2013 Bend Air Quality Index

AQI Days	All	PM2.5	CO
Good	332	332	153
Moderate	33	33	0
UFSG	0	0	0
Unhealthy	0	0	0
No AQI	0	0	11
Total	365	365	153

Source: DEQ website

Since the year 2000 there has been a general downward trend of PM10, PM 2.5 and carbon monoxide in the Bend area. PM10 standards were exceeded once each in 1996 and 2000.

The fugitive dust portion of the Emission Inventory (EI) was not included in the statewide Emission Inventory for 2002. This is an important piece of the emissions picture. Deschutes County ranked sixth highest in the state for total fugitive dust, with most dust coming from unpaved roads (Calkins, 2007).

No open debris burning is permitted within the city limits of Bend.

The U.S. Environmental Protection Agency website shows trends for releases from 1988 – 2012 for Deschutes County. Two areas reported releases. They are fugitive air emissions and stack/point source emissions. Fugitive air emissions are all releases to air that are not released through a confined air stream. Fugitive emissions include equipment leaks, evaporative losses from surface impoundments and spills, and releases from building ventilation systems. Stack or point source air emissions occur through confined air streams such as stack, vents, ducts, or pipes. The trend since 1988 has been generally trending sharply downward.

Recommendations

Use the transportation demand model, the complimentary air quality models, and the emissions inventory to analyze the impact of proposed transportation projects to air quality.

See also the recommendations in the Climate Change section of this report for other actions that will mitigate air quality conflicts.

Scenic Resources

Summary

The Scenic Resources section of this chapter focuses on a variety of protected scenic resources in the BMPO. Data were gathered from Deschutes County and Deschutes National Forest and others. Documents reviewed include management plans for the scenic byway and the wild and scenic river segments, county zoning regulations and Oregon statutes and policies. Of the approximately 14 miles of river running through the BMPO, nearly 11 miles are designated scenic. There is one map for this section: Map 13 Scenic Resources. Potential conflicts resulting from transportation projects include degrading scenic resources by building new projects in view corridors and air pollution obscuring views. Potential conflicts have been identified for the Cooley Road Project. Avoiding conflicts with scenic resources is the preferred mitigation.

Methodology

The following agencies were the primary resources for this section although other agencies, organizations and individuals may also have been contacted.

- City of Bend
- Deschutes County
- Deschutes National Forest

The following were the primary documents reviewed for this section:

Title	Source	Date
Cascade Lakes Scenic Byway, Corridor Management Plan	U.S. Forest Service	July 1996
Cascade Lakes Scenic Byway, Interpretive Plan	U.S. Forest Service	June 1996
Upper Deschutes Wild and Scenic River and State Scenic Waterway Comprehensive Management Plan	U.S. Forest Service	July 1996
Oregon Administrative Rules 736-040-0073; 736-040-0030; 736-040-0035	State of Oregon	
Oregon Revised Statute Chapter 390.805-995	State of Oregon	

Digital data layers were combined to create maps depicting the existing scenic resources. The following are the map titles along with the data layers shown and the source of the data. For details on the metadata see Appendix F.

Map #	Map Title	Data Layer	Data Source
13	Scenic Resources	Cascade Lakes National Scenic Byway	City of Bend (created)
		County Landscape Management Combining Zone	Deschutes County
		County Landscape Management Combining Zone - Water	Deschutes County
		Federal Wild and Scenic Rivers	Deschutes County
		State Scenic Waterways	Deschutes County

All known data necessary for this section was collected. The Federal Wild and Scenic River boundaries may be slightly inaccurate.

Findings

There are significant scenic resources within the BMPO. Views of Three Sisters, Mt. Bachelor, Tumalo Mountain and Broken Top along with the Deschutes River are all visible and prominent from the BMPO. Numerous protections exist for scenic resources including:

- County Landscape Management zones
- Cascade Lakes National Scenic Byway
- State Scenic Waterway designation
- Federal Wild and Scenic River designation

These are all protected resources with varying levels of requirements that must be taken into account in all transportation projects. All of the areas are identified on Map 13 and described below.

County Landscape Management Combining Zone

The purposes of Deschutes County's Landscape Management Combining Zone are to maintain scenic and natural resources of the designated areas and to maintain and enhance scenic vistas and natural landscapes as seen from designated roads, rivers or streams². To implement the zone, the County regulates new structures and landscaping to avoid impacts to scenic views from roads, on rimrock and near rivers. The zone applies to all areas within ¼ mile of the roads in the zone and in State Scenic Waterway and the Federal Wild and Scenic River corridor and all areas within 660 feet of rivers and streams otherwise identified as landscape management corridors in the comprehensive plan and the County Zoning Map.

National Scenic Byway

The route on Forest Highway 46 between Bend and Highway 58 is designated as the Cascade Lakes National Scenic Byway. It begins with the Tour Route in Drake Park and follows Galveston to 14th Street. The Byway begins at edge of the Urban Growth Boundary on the way to Mt. Bachelor at the Deschutes National Forest boundary, travels through the Cascade Lakes recreation area adjacent to the Three Sisters Wilderness, and ends at the junction of Road 61 and Highway 58 close to Crescent Lake. It received its designation for its outstanding scenic, natural, and recreational qualities. There are numerous goals for the Byway including the reduction of impacts from billboards and protection of scenic views, wildlife and recreation opportunities. While there are no specific regulations associated with the Byway, it is a nationally and regionally recognized resource as well as a part of Oregon's state scenic byways program. The U.S. Forest Service administers the program. The Federal Highway Administration administers a program that awards funds competitively each year in the form of merit –based grants covering 80 percent of the project cost and with the requirement that the remaining 20 percent be matched by local, state, other federal or in-kind means. Funds have been secured in the past for projects along the Cascade Lakes National Scenic Byway.

Scenic Waterways and Wild and Scenic River designation

Of the approximately 14 miles of river within the BMPO, about 10.8 miles are designated scenic. There are two sections of State Scenic Waterway in the BMPO – one in the north and the other at the south end of the BMPO, encompassing a total of 8.4 miles (Map 13). The south section enters the BMPO's southern boundary and ends at the Central Oregon Irrigation District diversion. The north section starts just below the North Unit Dam (near Mt. Washington Drive) and continues through the BMPO to the north. Oregon State rules govern the Scenic Waterway program and The Upper Deschutes Wild and Scenic River and State Scenic Waterway Comprehensive Management Plan contains specific rules that address setbacks, building color, vegetation retention, river crossings, screening and timber harvest for the southern section within a ¼ mile of the designated river sections. Oregon Park and Recreation Department administers the program.

² See Deschutes County Code (DCC) Chapter 18.84.

There is one stretch of Federal Wild and Scenic River within the BMPO that begins just outside the City of Bend city limits and is about 2.4 miles long within the BMPO. Protection for federal scenic rivers is focused on the “outstandingly remarkable values” that have been identified for the river including geologic, hydrologic, fishery, vegetative, wildlife, cultural, recreational and scenic values. The Upper Deschutes Wild and Scenic River and State Scenic Waterway Comprehensive Management Plan identifies goals, standards and guidelines for each of the values. This program has similar goals to the state program but differs in the type of protection offered. The U.S. Forest Service administers this program.

Potential Conflicts

Potential conflicts from transportation to the scenic resource could come from the building or rebuilding bridges over the river near the designated scenic sections or building roads within a quarter to a half-mile of designated resources. There are potential conflicts identified for the Cooley Road extension project for the State Scenic Waterway and the County Landscape Management Combining Zone.

Recommendations

- For all transportation projects, review the Scenic Resources map and identify and potential conflicts.
- For the Cooley Road extension project: Design the project to avoid impacts to the State Scenic Waterway and the County Landscape Management Combining Zone.

Historic and Cultural Preservation

Summary

The Historic and Cultural Preservation section of this chapter focuses on designated historic and cultural resources in the BMPO. Data were gathered from the several sources including the Deschutes County Historical Landmarks Commission, Bend Landmarks Commission, the Oregon State Historic Preservation Office, the Bureau of Land Management and the Deschutes National Forest. Documents reviewed include websites, regulations, reference materials and maps on historic and cultural resources. Resources identified include two historic districts and other individual resources listed on the National Register of Historic Places. All properties listed on the National Register, properties located in the two historic districts, and other properties that may be eligible for listing on the National Register of Historic Places are subject to Federal Section 4(f) regulations. Map 14: Cultural Resource Protection shows these resources and also some archeological high sensitivity areas. The Oregon State Archaeologist and the Landmarks Commission report that there are many archaeological reports filed about sites in the study area, but they are not available to show on a map. No potential conflicts to the resources resulting from transportation projects were identified, but a request for further review by the Oregon State Historic Preservation Office will be necessary on a case-by-case basis when specific transportation projects are funded. Avoiding conflicts with historic and cultural resources is required, if other alternatives exist, by federal law and is the preferred course of action.

Methodology

The following agencies were the primary resources for this section although other agencies, organizations and individuals may also have been contacted.

- Deschutes County Historical Landmarks Commission
- Bend Landmarks Commission
- Deschutes County
- Oregon State Historic Preservation Office (SHPO)
- U.S. Department of Agriculture, Deschutes National Forest
- Bureau of Land Management

Several conversations were held with the Confederated Tribes of Warm Springs, but no data were collected.

Also contacted by letter and phone with no response:

- Burns-Paiute Tribe
- Klamath Tribe

The following were the primary documents reviewed for this section:

Title	Source	Date
A Cultural Resource Survey of the Deschutes River from Bend to the Deschutes Jefferson County Line, Deschutes County Oregon	Scott, Sara A.	Jan 1986
National Register of Historic Places	National Park Service web site and the Oregon State Historic Preservation Office	2014
City of Bend General Plan, Chapter 3	City of Bend	1998
City of Bend website; Community Development Department Historic Preservation	http://www.ci.bend.or.us/depts/community_development/planning_division/historic_preservation.html	n/a
Section 4(f) of the Department of Transportation Act (<u>49 USC303 and 23 USC 138</u>)	Department of Transportation	1966

Digital data layers were combined to create maps depicting environmental information available in 2007. The following are the map titles along with the data layers shown and the source of the data. For details on the metadata see Appendix F.

Map #	Map Title	Data Layer	Data Source
14	Cultural Resource Protection	Archeological Sites	Bureau of Land Management
		National Register Historic Districts	City of Bend Community Development Department
		Historic Resources	Deschutes County
		Craftsman Bungalows	Des Chutes Historical Center

The State Historic Preservation Office was contacted and they requested that the BMPO contact them on a case-by-case basis for each transportation project rather than attempting to document the entire BMPO area.

Findings

Historic Resources

Based on the Historic Sites Database from the Oregon State Historic Preservation Office data, there are two National Register of Historic Places Historic Districts in the BMPO (Drake Park Historic District and Old Town Historic District), 410 properties that are listed on the National Register of Historic Places as part of these two historic districts, and 26 individually listed properties (including the two historic districts). There are also numerous individually designated historic and cultural buildings and sites (Map 14 and Appendix F). The Bend Landmarks Commission is the review body for projects that may affect a designated cultural or historical site within the City of Bend.

In addition to the listings on the National Register, Bend City Council adopted a list of historic and cultural resources that has been approved by Oregon Land Conservation and Development Commission (Appendix F). Any land use action or building modification to the historic structures on the approved list must be reviewed and approved by the Bend Landmarks Commission. These properties may also be protected by Section 4(f) for transportation projects. Additionally, the Craftsman bungalows identified as potentially eligible for the National Register may also be 4(f) properties (Map 14).

Cultural Resources

There are three tribal nations, which may consider the area where the BMPO is today their usual and accustomed summer camps, hunting and gathering areas. They are the Confederated Tribes of Warm Springs, the Burns Paiute Tribe and the Klamath Tribe. Each Tribe should be contacted on a case-by-case basis as transportation projects move forward. Areas of “high sensitivity” for archaeological sites identified by the Bureau of Land Management’s Prineville Office were also included on Map 14. These mapped resources do not represent all of the archeological resources and case-by-case research and/or surveys will be required. There are over 1,800 significant sites in Deschutes County that have been identified by archaeological reports filed with the State Historic Preservation Office.

Section 4(f)

Section 4(f) of the U.S. Department of Transportation Act provides protection to historic resources from transportation projects. Historic sites listed on or eligible for listing on the National Register of Historic Places are considered “significant” and therefore considered Section 4(f) properties by the Federal Highway Department (FHWA). FHWA projects are prohibited from using land from any significant historic site (publicly or privately owned) unless there is no alternative to the use of land. The proposed action must also include planning to minimize harm to the property that would result from such use. Section 4(f) applies to all archaeological sites on or eligible for inclusion on the National Register, including those discovered during construction. Numerous 4(f) properties are identified within the BMPO. *De minimis* impacts related to historic sites are defined as the determination of either "no adverse effect" or "no historic properties affected" in compliance with Section 106 of the National Historic Preservation Act. (www.state.in.us/dot/div/envassess/manuals/studies/30_section_4f.pdf)

Conflicts

No impacts from transportation projects to any of the historical resources on Map 14 were identified but it will be necessary for each project to consult with the State Historic Preservation Office on a case-by-case basis.

Recommendations

- Consult with the Bend Landmarks Commission, the State Historic Preservation Office, and the tribes on a case-by-case basis for each proposed transportation project to determine if there is the presence of any historical or archeological resources or Section 4 (f) property.
- For any Section 4(f) property identified, property boundaries shall be defined and jurisdictional responsibilities identified. The BMPO shall work with the responsible jurisdiction to avoid impacts to the 4(f) lands according to federal requirements.

Recreation Resources

Summary

The Recreation Resources section of this chapter identifies the recreational facilities, parks and trails within the BMPO. Data were gathered from agencies including the Bend Metro Park and Recreation District, Oregon Parks and Recreation Department, Deschutes County, and the City of Bend. Documents reviewed include comprehensive plans and zoning regulations. This section is related to the sections on Historic and Cultural Resources and Fish and Wildlife Resources because all are provided some protection under Section 4(f) of the U.S. Department of Transportation Act. There are significant recreation resources within the BMPO and they are shown on Map 15: Public Lands and Trails. Conflicts that could potentially result from transportation project include crossing recreational trails and other impacts to recreational lands and facilities. There are minor potential conflicts with parks, primarily in trail crossings. Avoiding impacts to parks and trails consistent with federal and state law is required.

Methodology

The following agencies were the primary resources for this section although other agencies, organizations and individuals may also have been contacted.

- Bend Metro Park and Recreation District
- City of Bend
- Deschutes County
- Oregon Parks and Recreation Department
- U.S. Department of Agriculture, Deschutes National Forest
- U.S. Department of Interior, Bureau of Land Management

The following were the primary documents reviewed for this section:

Title	Source	Date
Bend Metro Park and Recreation Comprehensive Plan	Bend Metro Park and Recreation District	2005
Deschutes County Zoning regulations	Deschutes County	2001
City of Bend General Plan	City of Bend	1998
Section 4(f) of the Department of Transportation Act (49 USC303 and 23 USC 138)	Department of Transportation	1966
Section 6(f)(3) of the Land and Water Conservation Fund	National Park Service	1964
Section 6(f)(3) of the Land and Water Conservation Fund properties	National Park Service	2014

Digital data layers were combined to create a map depicting recreation resource information available in 2007. The following is the map title along with the data layers shown and the main source of the data. For details on the metadata see Appendix F.

Map #	Map Title	Data Layer	Data Source
15	Public Lands & Trails	Bend Metro Park and Recreation District Parks and Trails	Bend Metro Park and Recreation District
		Bureau of Land Management lands	Deschutes County
		City lands	City of Bend
		County lands	Deschutes County
		Other – Federal lands	Deschutes County
		Other Parks	Deschutes County, Bend Metro Park and Recreation District
		State land	Deschutes County
		Trails	City of Bend
		U.S. Forest Service lands	Deschutes County

There are many acres of lands managed by the Bureau of Land Management (BLM) and the Deschutes National Forest surrounding the BMPO. These agencies provided maps and documents regarding these lands, but no recreational lands were identified within the BMPO boundary.

A list of projects that received funding from the federal Land Water Conservation Fund program was available and there are numerous facilities in the BMPO that have received these funds. Further research is needed to determine if the entire park property upon which improvements have been made is affected as many of the LWCF improvements were made in parks that are composed of multiple parcels. Also, some of the parks have changed names or management over the years. There are also 4(f) properties – “significant publicly owned” parks. A list of these properties will require further research.

Findings

The BMPO benefits from an abundance of parks and trails. Numerous agencies provide park land and facilities in the area including Oregon Parks and Recreation Department, Deschutes County and the City of Bend, but the primary provider of parks and trails is the Bend Metro Park and Recreation District which is a separate jurisdiction from the city. The District currently manages 81 parks and natural areas and 65 miles of trail within the BMPO. In addition to all of the recreation land and facilities within the BMPO, the area is surrounded by thousands of acres of lands managed by the Bureau of Land Management (BLM) and the Deschutes National Forest. The Forest/Urban interface lands on Bend’s west side are receiving increasing recreation use and pressure as the Bend population has grown and residents demand close to home opportunities. Providing for and managing interface trail connections are of particular concern to the responsible agencies (Ronning, 2007.)

There are two federal acts that provide protection to recreational lands under certain conditions. The provisions for protection are in Section 6(f)(3) of the Land and Water Conservation Fund (LWCF) and in Section 4(f) of the U.S. Department of Transportation Act 1966.

Section 6(f)(3) of the LWCF Act states “No property acquired or developed with assistance under this section shall, without the approval of the Secretary, be converted to other than public outdoor recreation uses. The Secretary shall approve such conversion only if he finds it to be in accord with the then existing Statewide Comprehensive Outdoor Recreation Plan (SCORP) and only upon such conditions as he deems necessary to assure the substitution of other recreation properties of at least equal fair market value and of reasonably equivalent usefulness and location.” This “anti-conversion” requirement applies to all parks and other sites that have been the subject of Land and Water grants of any type, whether for acquisition of parkland, development or rehabilitation of facilities. In many cases, even a relatively small LWCF grant (e.g., for development of a picnic shelter) in a park of hundreds or even thousands of acres provides anti-conversion protection to the entire park site (Haupt, 2007).

There are numerous recreation facilities within the BMPO that have been supported by LWCF monies over the years including the Juniper Swim and Fitness Center, Skyline Sport Park, and Hollinshead Historical Park as well as numerous smaller community and neighborhood park projects. The LWCF program provides matching grants to

States and local governments for the acquisition and development of public outdoor recreation areas and facilities. The LWCF website lists 18 projects funded by the LWCF in the BMPO area (Appendix F) totaling approximately \$1,300,000 since 1966, many of which are within the BMPO. Further research will be required to determine the boundaries of each property parcel and if each property meets the requirements for protection from transportation projects.

Section 4(f) of the US Department of Transportation Act also provides protection to recreation lands from transportation projects. Federal Highway Administration projects are prohibited from using land from a publicly owned park or recreation area unless there is no feasible and prudent alternative to the use of land. *De minimis* impacts on publicly owned parks, recreation areas, and wildlife and waterfowl refuges are defined as those that do not "adversely affect the activities, features and attributes" of the Section 4(f) resource. The use of land from a publicly owned school playground may require Section 4(f) documentation. If the playground is open to the public and serves either organized or recreational purposes (walk-in activity), it may be subject to section 4(f) if the playground is determined to be significant for recreational purposes. Section 4(f) does not apply to planned trails if the land for the planned trail is not currently publicly owned. Additional criteria would need to be met for Section 4(f) to apply to any planned trail on publicly owned land. There are existing park and recreational resources in the BMPO that qualify as 4(f) properties; however the transportation projects proposed avoid nearly all lands identified on Map 15. The Pine Nursery, a large parcel located in the northeast quadrant of the BMPO is a newly constructed park. This land was formerly managed by the federal government and required two separate acts of congress to transfer it to local jurisdiction. A road improvement is planned through the southwest corner of the property; however the right-of-way agreement with Deschutes County was in place at the time the park and recreation district acquired the property and the park has been designed around the future road improvement.

Recommendations

In the early stages of planning for transportation projects in the BMPO, a survey should be conducted to identify all 4(f) and 6(f)(3) properties in the vicinity of the proposed project. Property boundaries defined and jurisdictional responsibilities should be identified. The BMPO should work with the responsible jurisdiction to avoid, reduce or minimize impacts to the 4(f) or 6(f)(3) properties consistent with requirements outlined in the respective regulations.

Environmental Justice

Summary

The Environmental Justice section of this chapter identifies low-income and minority households within the BMPO as required by Executive Order 12898. Data were collected from agencies including the Federal Highway Administration and the Census Bureau. Documents reviewed include Census information, general information on environmental justice issues and the Executive Order requiring this analysis. Two maps were developed for this section using 2000 U.S. Census data: Map 16, percent of

minority households by census block group and Map 17, percent of low-income households by census block group. Year 2010 U.S. Census data show that there are low-income and minority households within the BMPO, especially along Highway 97. Conflicts that could potentially result from transportation projects include disproportionately high and adverse effects on human and environmental health, including social and economic effects. Recommendations include avoiding, minimizing, or mitigating disproportionately high or adverse human health and environmental effects, including social and economic effects, on minority populations and low-income.

Methodology

The following agencies were the primary resources for this section although other agencies, organizations and individuals may also have been contacted.

- Federal Highway Administration
- Oregon Department of Transportation

The following were the primary documents reviewed for this section:

Title	Source	Date
Memo: FM Larry D. Anderson RE: Environmental Justice	Larry D. Anderson	May 10, 2006
GIS Mapping Report of Environmental Justice Census Characteristics	Randy Johnson, OSU; Alan Kirk, ODOT	October 1, 2004
An Overview of Environmental Justice and Transportation	Federal Highway Administration	May 2000
U.S. Department of Transportation, Environmental Justice website	Federal Highway Administration	
2010 U.S. Census data	U.S. Census Bureau	
2014 U.S. Census Bureau "Quick Facts" for Bend, Oregon	U.S. Census Bureau	

Digital data layers were combined to create maps depicting 2000 U.S. Census information on environmental justice. The following are the map titles along with the data layers shown and the source of the data. For information on the metadata see Appendix F.

Map #	Map Title	Data Layer	Data Source
16	Percent of Minority Households	Minorities	ODOT
17	Low of Income Households	Low income households	ODOT

Findings

Executive Order 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, 1994) requires that every transportation project nationwide consider the human environment. The Order states, "Each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." In addition, Title VI of the Civil Rights Act of 1964 states,

"No person in the United States shall, on the ground of race, color, or national origin be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance."

There are three fundamental environmental justice principles:

- To avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations.
- To ensure the full and fair participation by all potentially affected communities in the transportation decision-making process.
- To prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations.

To certify compliance with Title VI and address environmental justice, MPOs need to:

- Enhance their analytical capabilities to ensure that the long-range transportation plan and the transportation improvement program (TIP) comply with Title VI.
- Identify residential, employment, and transportation patterns of low-income and minority populations so that their needs can be identified and addressed, and the benefits and burdens of transportation investments can be fairly distributed.
- Evaluate and - where necessary - improve their public involvement processes to eliminate participation barriers and engage minority and low-income populations in transportation decision-making. For example, the BMPO focused resources for public involvement to the Latino community for the BMPO transit planning process.

Low income

U.S. Census Bureau American Community Survey data indicates that approximately 12.0% of the total population in the City of Bend lived below the poverty level between 2008 and 2012. More than 15% of persons within the following census tracts lived below the poverty level (2008 to 2012):

- The census tract generally bounded by NW Franklin Avenue to north, NE/SE 9th Street to the east, SE Reed Market Road to the south, and the Deschutes River to the west (15.9% of the total population living below the poverty level).
- The census tract generally bounded by NE Butler Market Road to the north, NE 27th Street to the east, NE Neff Road to the south, and NE 13th Street to the west (18.2% of the total population living below the poverty level).

Minorities

Year 2010 U.S. Census data indicates that 91.3% of Bend's population identified as White alone, and 87.3% identified as White alone, not Hispanic or Latino. 2010 Census data shows that generally the census block groups east of the Deschutes River are all at least 10% minority and the block groups west of the Deschutes River are less than 10% minority. The following block groups in Bend exceeded a minority of population of 20% in 2010:

- The block group generally bounded by SW Wilson Avenue to the north, SW 3rd Street to the east, Central Oregon Canal to south, and SW Bond Street to the west had a minority population of approximately 20.8%.
- The block group generally bounded by the North Canal to the north, NE 12th Street/NE Butler Market Road to the east, NE Revere Street to the south, and NE Boyd Acres Road/NE Studio Drive to the west had a minority population of approximately 22.2%.
- The block group generally bounded by the Central Oregon Canal to the north, 3rd Street to the east, SW Mahogany Street to the south, and SW Brookwood Boulevard to the west had a minority population of approximately 24.9%.
- The block group generally bounded by SE Glenwood Drive to the north, SE 9th Street to the east, SE Wilson Avenue to the south, and SE 3rd Street to the west had a minority population of approximately 33.2%.

Recommendations

Avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations.

Ensure that the long-range transportation plan and the transportation improvement program comply with Title VI.

Future work to be Completed

Conduct further analysis as new census data becomes available, such as through Environmental Justice/Title VI plan updates

Identify residential, employment, and transportation patterns of low-income and minority populations so that their needs can be identified and addressed, and the benefits and burdens of transportation investments can be fairly distributed.

As resources allow, conduct an environmental justice/Title VI assessment of the BMPO TIP and plan.

As resources allow, update the BMPO Public Participation Plan prepared in 2009, which encourages the participation and engagement of minority and low-income populations in transportation decision-making, including by providing Spanish translations of printed materials and at meetings if needed.

Noise

This section will be added as part of a future MTP update.

Chapter 19: Financial Analysis

Introduction

The Bend Metropolitan Planning Organization (BMPO) is responsible for preparing a long-range regional transportation plan for the Bend metropolitan area. That plan is called the Metropolitan Transportation Plan (MTP). The MTP takes a “big-picture” look at future demand for all modes of transportation in the Bend region and how that demand might be accommodated by investments in infrastructure. The MTP is an initial step in developing the region's network of transportation facilities and services, and serves as a framework for more detailed project planning.

The rules of the Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) require the MTP to be “fiscally constrained,” meaning that the cost of projects included in the MTP cannot exceed the capacity of the region to fund the projects. This chapter estimates the level of transportation-related funding that jurisdictions in the Bend MPO can reasonably expect to have available over the planning period. This report provides a basis for making decisions about the amount of revenue available over the next 25 years to fund regional transportation improvements.

The purpose of this chapter is to provide the financial context for the discussion and evaluation of projects. This chapter presents an analysis of funding resources that the BMPO can reasonably expect to fund the projects in the Plan and to support operations and maintenance of the transportation system. This report summarizes research on reasonably available funding resources, and compares those resources to estimated project costs, to help generate the fiscally constrained project list.

This chapter focuses on estimating revenues that will be available over the next 25 years for transportation improvements in the region. Other parts of the plan discuss potential projects, their benefits, and their costs. A subsequent and critical step in the planning process is the comparison of the revenue estimates in this report to project performance measures and costs in other reports to decide on the best package of transportation improvements that can be assembled within the agreed upon revenue constraints.

This MTP addresses only the regional transportation system. Regional facilities include all state transportation facilities, major arterials and minor arterials, and some major collectors. Local facilities (the remainder of the collector system and local roads) are not addressed in the plan.

Framework

Context

Legislative framework

The bulk of people and freight using the transportation system are traveling on roads in cars, trucks, and buses. In addition, many walkways and bicycle facilities are part of the roadway system. The roadway system in the United States is primarily owned and operated by the public sector. While the system of freeways, highways, and streets function as a single system, it is the joint responsibility of federal, state, and local governments to build and maintain this system.

Road systems in urban areas are extensive and cross many jurisdictions. Efficiently building and maintaining such a complex system requires planning to coordinate the investments of multiple jurisdictions. Large urban areas are required by federal and Oregon law to coordinate plans for transportation improvements at a regional level. The regional (or metropolitan) transportation plan serves this function by considering long-run transportation needs at a regional level and identifying policies, programs, and projects to meet these needs. The plans of local jurisdictions responsible for the transportation system in the Bend metropolitan area must be consistent with the policies, programs, and projects identified in the MTP.

While measures in an MTP can include policies, strategies, and programs, the focus of an MTP is usually on capital investments to improve existing roadways, construct new roadways, and improve transit service. A key requirement for regional transportation plans is that they be fiscally constrained—the cost of actions identified in the MTP cannot exceed the level of funding considered reasonably available in the region. In addition, projects must be in the MTP to be eligible for most federal and state funding programs. ODOT, Deschutes County, the City of Bend, and Cascades East Transit (CET) each prepare short-term capital improvement plans that identify projects that will be funded in the near future, generally the next three to five years. Projects built and operated by jurisdictions in the BMPO area must be consistent with the MTP in order to be eligible for federal funding.

The cost of all projects in a region that could contribute to system improvements almost always exceeds the financial resources considered reasonably available to pay for the projects. For these reasons, the biggest and defining task of a metropolitan transportation plan is to select and prioritize projects within the constraint of available funding. A metropolitan transportation plan also describes projects beyond those that fall within whatever definition of fiscal constraint that a region ultimately chooses. These projects are considered illustrative: they could be included in the fiscally constrained set of projects if new funding sources are found. Moreover, even if they are not part of the fiscally-constrained set of projects, they are potentially part of a longer-run transportation plan, and give local governments some ability to conduct certain planning studies that might be necessary given the long time it takes for project development.

Transportation Funding Principles

Projects to improve the transportation system are funded through a mix of federal, state, and local revenues distributed through a variety of funding programs that dictate how this revenue can be spent. In addition to revenue generation and spending by multiple jurisdictions, revenue sharing among jurisdictions and cooperation among multiple jurisdictions on individual projects makes describing transportation funding complicated.

To organize this review of available transportation funding in the Bend metropolitan area, the chapter focuses on the sources of public funding for transportation and how those funds are spent.

There is a distinction between the terms “funding” and “financing,” which often get used interchangeably. Providing transportation facilities and services costs money, and somebody has to pay for these costs. The ultimate source of revenue for these costs is funding. When the funds for transportation costs are borrowed and paid back over time, then these costs have been financed. Public agencies finance costs for the same reasons as households and businesses—to reduce the current out-of-pocket costs by spreading out payments over time.

Definitions

Revenue sources:

- **State Highway Fund (SHF)** is composed of several major funding sources: Motor Vehicle Registration and Title Fees, Driver License Fees, Motor Vehicle Fuel Taxes, and Weight-Mile Tax. The SHF funds are apportioned to three jurisdiction levels in the following amounts: State (59%), Counties (25%), and Cities (16%).
- **Statewide Transportation Improvement Program (STIP)** is Oregon’s four-year transportation capital improvement program. This program defines which projects will be funded by what amount of money throughout the planned four-year program period. Projects at all jurisdiction levels are included in the program; Federal, state, county, and city.
- **Surface Transportation Program (STP)** is a major federal transportation program to provide “flexible” funds for transportation projects at the state and local levels. Funds are “flexible” in that they can be spent on a variety of transportation related projects, e.g., mass transit, bike-ped.
- **System Development Charges (SDC)** are fees collected when new development occurs within the City of Bend. These fees are then used to partially fund capital improvements, such as new streets within the city.

Other key terms and acronyms:

- **Peak Hour Trips (PHTs)** are those trips made during the busiest hour within the morning and evening peak traffic flow periods. In this report PHTs are used to forecast SDC revenue arising from future, new development.

- **Fiscal Year End (FYE)** denotes the completion of a one-year, or 12-month, accounting period. For example, FYE 2015 refers to the 2014-15 fiscal year, ending June 30, 2015.
- **Year of Expenditure (YOE)** denotes that dollar values are reported as nominal values, which increase over time due to assumed inflation rates.
- **Constant 2015 \$** denotes that dollar values are reported in constant terms based on FYE 2015 values. These values remain constant over time, and do not reflect changes in value due to inflation.

Methods

To complete this chapter, the following steps were followed:

- **Reviewed existing data and previous studies.** Primary documents reviewed included ODOT's *June 2010 Revenue Forecast* and the Bend Transportation System Plan. Also reviewed were:
 - City of Bend Adopted Biennial Budgets, 2013-2015 and 2011-2013
 - ODOT Fund Apportionments, Receipt Distribution for FY 2013-2014
 - City of Bend Transportation Operations Forecast, January 2014
 - ODOT Statewide Transportation Improvement Plan 2015-2018
 - Deschutes County, Oregon Proposed Budget Fiscal Year 2015
 - Deschutes County, Oregon Adopted Budget Fiscal Year 2013
 - Bend MPO Peak Hour Trip (PHT) Forecast, DKS Associates
- **Conferred with staff from relevant State and local agencies.** Discussions with staff from agencies that provide transportation services to gain insight into local transportation funding plans and policies.

Assumptions

We relied upon numerous assumptions to forecast future revenues and expenditures. Throughout this chapter, we identify the assumptions used in our analysis. However, there are a few key assumptions applied to numerous calculations throughout our analysis. Those assumptions are the future inflation rate, and the pace of future development, as measured by Peak Hour Trips (PHT). Exhibit 1 shows the assumed inflation rate of 3.1 percent, which is the same rate used by ODOT in their most recent long-range revenue forecast. Exhibit 2 shows the assumed phasing of new PHTs, based on projections from DKS Associates.

Exhibit 1. Assumed inflation index used in this analysis, FYE 2015 to 2040

FYE	Index
2015	1.0000
2016	1.0310
2017	1.0630
2018	1.0960
2019	1.1300
2020	1.1650
2021	1.2011
2022	1.2383
2023	1.2767
2024	1.3163
2025	1.3571
2026	1.3992
2027	1.4426
2028	1.4873
2029	1.5334
2030	1.5809
2031	1.6299
2032	1.6804
2033	1.7325
2034	1.7862
2035	1.8416
2036	1.8987
2037	1.9576
2038	2.0183
2039	2.0809
2040	2.1454

Source: ODOT Long-Range Revenue Tables 2013 v3.

Exhibit 2. Forecast growth in Peak Hour Trips, BMPO, FYE 2015 to 2040

FYE	PHT	Total PHT
2015	716	52,318
2016	726	53,044
2017	736	53,780
2018	746	54,526
2019	756	55,282
2020	767	56,049
2021	777	56,826
2022	788	57,614
2023	799	58,413
2024	810	59,223
2025	821	60,044
2026	833	60,877
2027	844	61,721
2028	856	62,577
2029	868	63,445
2030	880	64,325
2031	892	65,217
2032	904	66,121
2033	917	67,038
2034	930	67,968
2035	943	68,911
2036	956	69,867
2037	969	70,836
2038	982	71,818
2039	996	72,814
2040	1,011	73,825

Source: PHT forecast provided by DKS

Organization of this chapter

The remainder of this chapter describes future revenue forecasts. It is organized first by jurisdiction, including separate sections for the City of Bend, Oregon Department of Revenue, Deschutes County, and Cascades East Transit. Within each of those sections, we first describe revenues for operations, maintenance, and administration, and then describe revenues available for capital projects. All forecasts are shown in both Constant 2015 dollars as well as Year of Expenditure dollars.

Revenue forecasts

The revenue forecasts in this chapter are organized first by the entity receiving the revenue (City, County, ODOT, and CET), and then by the purpose of the revenue (operations and maintenance and administration versus capital projects). We provide recent historical data on these revenues, and then long-term forecasts.

City of Bend

The City of Bend owns and maintains the vast majority of the roadway network in the BMPO. Thus, the City of Bend has primary responsibility for funding transportation operations and maintenance and new capital projects in the BMPO. As such, the majority of our analysis focuses on these City of Bend revenue sources.

Operations and maintenance and administration

The City of Bend's budget is biennial; revenue amounts for the three most recent biennia are reported below in Exhibit 3. The City's total resources for transportation operations and maintenance have grown over this time period, exceeding \$20 million in available funds in the 2013-15 biennium. Intergovernmental revenues (primarily allocations of State Highway Fund revenue) is the largest revenue source, accounting for more than half of all revenue. The City's general fund is the next largest source of revenue for transportation operations and maintenance and administration.

**Exhibit 3. Historical transportation revenues for operations, maintenance and administration,
City of Bend, Biennium 2009-11 to 2013-15 (YOE dollars)**

	Actual 2009-11	Adjusted 2011-12	Adopted 2013-15
Resources			
Beginning Working Capital	\$ 1,446,559	\$ 2,203,600	\$ 2,631,500
Franchise Fees	\$ 952,026	\$ 987,900	\$ 1,016,500
Intergovernmental Revenues	\$ 8,265,194	\$ 9,819,300	\$ 10,614,500
Charges For Services		\$ 51,800	
General Fund Subsidy-Overlay	\$ 2,235,00	\$ 3,513,889	\$ 4,600,000
General Fund Subsidy-Operations			\$ 300,000
License and Permits	\$ 53,052	\$ 68,200	\$ 215,400
Interfund Charges	\$ 1,051,289	\$ 2,071,100	\$ 1,114,600
Interfund Transfers		\$ 240,936	
Investment Income	\$ 21,959	\$ 23,900	\$ 30,800
Miscellaneous	\$ 160,724	\$ 60,800	\$ 47,100
Total Resources	\$ 14,185,803	\$ 19,041,425	\$ 20,570,400

Sources:

City of Bend, Oregon 2013-2015 2013 Adopted Biennial Budget; Page 223

City of Bend, Oregon 2011-2013 Adopted Biennial Budget; Page 163

Exhibit 4 shows ODOT forecasts for total State Highway Fund (SHF) revenues. ODOT forecasts steady growth in total SHF revenue through 2040, but the rate of growth (1.3%) is equal to the anticipated rate of inflation, resulting in a static annual funding amount as measured in constant 2015 dollars. SHF revenues have several major sources: Motor Vehicle Registration and Title Fees, Driver License Fees, Motor Vehicle Fuel Taxes, and Weight-Mile Tax. Note that the forecast of SHF revenue is divided into two categories: “current law” reflects revenues from these sources according to the rates in place prior to 2014, and “additional” revenue reflects increases in certain State taxes and fees that began taking effect in FYE 2014.

Exhibit 4. Projected State Highway Fund revenues, State of Oregon, FYE 2015 to 2040 (millions)

FYE	YOE \$			Constant 2015 \$		
	"Current Law"	"Additional"	Total SHF Revenues	"Current Law"	"Additional"	Total SHF Revenues
2015	\$ 1,073	\$ 29	\$ 1,103	\$ 1,073	\$ 29	\$ 1,103
2016	\$ 1,087	\$ 50	\$ 1,137	\$ 1,055	\$ 48	\$ 1,103
2017	\$ 1,101	\$ 71	\$ 1,172	\$ 1,036	\$ 67	\$ 1,103
2018	\$ 1,116	\$ 93	\$ 1,208	\$ 1,018	\$ 85	\$ 1,103
2019	\$ 1,130	\$ 116	\$ 1,246	\$ 1,000	\$ 102	\$ 1,103
2020	\$ 1,145	\$ 140	\$ 1,285	\$ 983	\$ 120	\$ 1,103
2021	\$ 1,160	\$ 165	\$ 1,324	\$ 966	\$ 137	\$ 1,103
2022	\$ 1,175	\$ 191	\$ 1,365	\$ 949	\$ 154	\$ 1,103
2023	\$ 1,190	\$ 218	\$ 1,408	\$ 932	\$ 170	\$ 1,103
2024	\$ 1,206	\$ 246	\$ 1,451	\$ 916	\$ 187	\$ 1,103
2025	\$ 1,221	\$ 275	\$ 1,496	\$ 900	\$ 203	\$ 1,103
2026	\$ 1,237	\$ 306	\$ 1,543	\$ 884	\$ 218	\$ 1,103
2027	\$ 1,253	\$ 337	\$ 1,591	\$ 869	\$ 234	\$ 1,103
2028	\$ 1,270	\$ 370	\$ 1,640	\$ 854	\$ 249	\$ 1,103
2029	\$ 1,286	\$ 405	\$ 1,691	\$ 839	\$ 264	\$ 1,103
2030	\$ 1,303	\$ 440	\$ 1,743	\$ 824	\$ 279	\$ 1,103
2031	\$ 1,320	\$ 478	\$ 1,797	\$ 810	\$ 293	\$ 1,103
2032	\$ 1,337	\$ 516	\$ 1,853	\$ 796	\$ 307	\$ 1,103
2033	\$ 1,354	\$ 556	\$ 1,910	\$ 782	\$ 321	\$ 1,103
2034	\$ 1,372	\$ 598	\$ 1,970	\$ 768	\$ 335	\$ 1,103
2035	\$ 1,390	\$ 641	\$ 2,031	\$ 755	\$ 348	\$ 1,103
2036	\$ 1,408	\$ 686	\$ 2,094	\$ 741	\$ 361	\$ 1,103
2037	\$ 1,426	\$ 732	\$ 2,159	\$ 728	\$ 374	\$ 1,103
2038	\$ 1,445	\$ 781	\$ 2,225	\$ 716	\$ 387	\$ 1,103
2039	\$ 1,463	\$ 831	\$ 2,294	\$ 703	\$ 399	\$ 1,103
2040	\$ 1,482	\$ 883	\$ 2,366	\$ 691	\$ 412	\$ 1,103

Source: ODOT Long-Range Revenue Tables 2013 v3. Summarized by ECONorthwest.

SHF revenue is allocated to three jurisdiction levels: State, Counties, and Cities. Exhibit 5 reflects these allocations. Note that the "Additional" revenues allocate a higher share of SHF revenues to cities and counties than to the State, so that the amount of SHF revenue for cities and counties increases over time in constant 2015 dollars, while the State share of SHF revenue decreases.

**Exhibit 5. Allocation of projected State Highway Fund revenues, State of Oregon,
FYE 2015 to 2040 (millions)**

FYE	YOE \$				Constant 2015 \$			
	State Share	County Share	City Share	Total	State Share	County Share	City Share	Total
2015	\$ 653	\$ 272	\$ 177	\$ 1,103	\$ 653	\$ 272	\$ 177	\$ 1,103
2016	\$ 672	\$ 281	\$ 184	\$ 1,137	\$ 651	\$ 273	\$ 178	\$ 1,103
2017	\$ 691	\$ 291	\$ 190	\$ 1,172	\$ 650	\$ 274	\$ 179	\$ 1,103
2018	\$ 710	\$ 301	\$ 197	\$ 1,208	\$ 648	\$ 275	\$ 180	\$ 1,103
2019	\$ 730	\$ 312	\$ 204	\$ 1,246	\$ 646	\$ 276	\$ 180	\$ 1,103
2020	\$ 751	\$ 323	\$ 211	\$ 1,284	\$ 645	\$ 277	\$ 181	\$ 1,103
2021	\$ 772	\$ 334	\$ 218	\$ 1,324	\$ 643	\$ 278	\$ 182	\$ 1,103
2022	\$ 794	\$ 345	\$ 226	\$ 1,365	\$ 641	\$ 279	\$ 182	\$ 1,103
2023	\$ 817	\$ 357	\$ 234	\$ 1,408	\$ 640	\$ 280	\$ 183	\$ 1,103
2024	\$ 840	\$ 369	\$ 242	\$ 1,451	\$ 638	\$ 281	\$ 184	\$ 1,103
2025	\$ 864	\$ 382	\$ 250	\$ 1,496	\$ 637	\$ 281	\$ 184	\$ 1,103
2026	\$ 889	\$ 395	\$ 259	\$ 1,543	\$ 635	\$ 282	\$ 185	\$ 1,103
2027	\$ 914	\$ 409	\$ 268	\$ 1,590	\$ 634	\$ 283	\$ 186	\$ 1,103
2028	\$ 940	\$ 422	\$ 277	\$ 1,640	\$ 632	\$ 284	\$ 186	\$ 1,103
2029	\$ 967	\$ 437	\$ 286	\$ 1,691	\$ 631	\$ 285	\$ 187	\$ 1,103
2030	\$ 995	\$ 452	\$ 296	\$ 1,743	\$ 630	\$ 286	\$ 187	\$ 1,103
2031	\$ 1,024	\$ 467	\$ 306	\$ 1,797	\$ 628	\$ 286	\$ 188	\$ 1,103
2032	\$ 1,053	\$ 483	\$ 317	\$ 1,853	\$ 627	\$ 287	\$ 189	\$ 1,103
2033	\$ 1,084	\$ 499	\$ 328	\$ 1,910	\$ 626	\$ 288	\$ 189	\$ 1,103
2034	\$ 1,115	\$ 516	\$ 339	\$ 1,969	\$ 624	\$ 289	\$ 190	\$ 1,103
2035	\$ 1,147	\$ 533	\$ 350	\$ 2,031	\$ 623	\$ 289	\$ 190	\$ 1,103
2036	\$ 1,180	\$ 551	\$ 362	\$ 2,093	\$ 622	\$ 290	\$ 191	\$ 1,103
2037	\$ 1,215	\$ 569	\$ 374	\$ 2,158	\$ 620	\$ 291	\$ 191	\$ 1,103
2038	\$ 1,250	\$ 588	\$ 387	\$ 2,225	\$ 619	\$ 292	\$ 192	\$ 1,103
2039	\$ 1,286	\$ 608	\$ 400	\$ 2,294	\$ 618	\$ 292	\$ 192	\$ 1,103
2040	\$ 1,323	\$ 628	\$ 414	\$ 2,365	\$ 617	\$ 293	\$ 193	\$ 1,103

Source: ODOT Long-Range Revenue Tables 2013 v3. Summarized by ECONorthwest.

Cities share of SHF revenue is allocated to individual cities based on population. In FYE 2014, the City of Bend received approximately 2.88% of the total cities share of SHF revenue. We assume Bend continues to receive this same percentage of the city share of SHF revenues through the 2040 forecast horizon. To the extent that the City of Bend's population growth outpaces the growth of other cities statewide, the City could receive an increasing share of SHF revenue. However, population estimates used for these allocations are taken from the decennial U.S. Census, which means that these population figures are updated only once per decade.

Exhibit 6 shows the projected allocation of SHF revenue to the City of Bend. Of the projected \$177 million in SHF revenue allocated to Oregon cities in FYE 2015, the City of Bend is forecast to receive approximately \$5.1 million. This is forecast to grow to nearly \$11.9 million in 2040, but in constant 2015 dollars the City of Bend's allocation of SHF money is anticipated to experience very modest growth during this period.

**Exhibit 6. Allocation of projected State Highway Fund revenues to the City of Bend,
State of Oregon, FYE 2015 to 2040**

FYE	Allocation to City of Bend	
	YOE \$	Constant 2015 \$
2015	\$ 5,102,633	\$ 5,102,633
2016	\$ 5,283,153	\$ 5,124,300
2017	\$ 5,469,561	\$ 5,145,401
2018	\$ 5,662,041	\$ 5,166,096
2019	\$ 5,860,786	\$ 5,186,536
2020	\$ 6,065,994	\$ 5,206,862
2021	\$ 6,277,870	\$ 5,226,767
2022	\$ 6,496,623	\$ 5,246,405
2023	\$ 6,722,472	\$ 5,265,506
2024	\$ 6,955,639	\$ 5,284,235
2025	\$ 7,196,357	\$ 5,302,746
2026	\$ 7,444,864	\$ 5,320,800
2027	\$ 7,701,404	\$ 5,338,558
2028	\$ 7,966,232	\$ 5,356,170
2029	\$ 8,239,609	\$ 5,373,424
2030	\$ 8,521,804	\$ 5,390,476
2031	\$ 8,813,095	\$ 5,407,138
2032	\$ 9,113,768	\$ 5,423,571
2033	\$ 9,424,120	\$ 5,439,608
2034	\$ 9,744,454	\$ 5,455,410
2035	\$ 10,075,085	\$ 5,470,832
2036	\$ 10,416,336	\$ 5,486,036
2037	\$ 10,768,543	\$ 5,500,890
2038	\$ 11,132,048	\$ 5,515,557
2039	\$ 11,507,209	\$ 5,529,919
2040	\$ 11,894,390	\$ 5,544,136

Source: Calculated by ECONorthwest based on the following sources:
 ODOT Long-Range Revenue Tables 2013 v3
 ODOT Fund Apportionments, Receipt Distribution for FY 2013-2014

In addition to SHF allocations, the City has additional revenue sources used for operations, maintenance, and administration of the transportation system. These revenue sources include an allocation from the City's general fund, and the City's franchise fees from garbage collection. The City provides a short-term (five-year) forecast of revenues and expenditures for transportation operations that is updated on an annual basis. The most recent update (January 2014) forecast general fund revenues to remain constant at \$3,000,000 per year (YOE dollars). However, the City does not anticipate that this level of general fund subsidy will be sustainable long-term, and that this revenue stream should not be relied on beyond the short-term, five-year forecast period. Thus, our long-term forecast assumes no general fund revenue beyond FYE 2019.

The City does not have a current forecast of garbage franchise fee revenues for transportation. Conversations with the City's interim finance director indicated that this revenue amount is fairly flat over time, although modest growth (in YOE dollars) can be seen in Exhibit 3 over the past six years. Based on the historical budget data and input from the City's interim finance director, we have assumed that garbage franchise fee

revenues will experience growth equal to the rate of inflation, resulting in no change in funding levels as measured in constant 2015 dollars.

Other funding sources for operations, maintenance and administration include interfund charges and transfers, investment income, licenses and permits, charges for services and other miscellaneous sources. We forecast that these sources will increase over time based on the pace of new development (1.35% per year as measured by new PHTs), and the assumed rate of inflation (3.1% per year, as used in ODOT long-term revenue forecasts).

Exhibit 7 shows the forecast of City revenues for transportation operations, maintenance and administration in constant 2015 dollars. Total revenues are expected to decrease from \$9.5 million per year in FYE 2015 to \$7.3 million per year in FYE 2040. This decrease is due to the lack of general fund subsidy as a permanent funding source.

Exhibit 7. Projected annual revenue sources available for transportation operation and maintenance and administration, City of Bend, FYE 2015 to 2040 (Constant 2015 \$)

FYE	Revenue for O & M and Administration					Total for O & M and Admin
	State Highway Fund	General Fund	Garbage Franchise Fees	Other		
2015	\$ 5,102,633	\$ 3,000,000	\$ 508,250	\$ 868,610	\$ 9,479,493	
2016	\$ 5,124,300	\$ 2,909,796	\$ 508,250	\$ 880,362	\$ 9,422,708	
2017	\$ 5,145,401	\$ 2,822,201	\$ 508,250	\$ 892,240	\$ 9,368,092	
2018	\$ 5,166,096	\$ 2,737,226	\$ 508,250	\$ 904,273	\$ 9,315,845	
2019	\$ 5,186,536	\$ 2,654,867	\$ 508,250	\$ 916,488	\$ 9,266,141	
2020	\$ 5,206,862	\$ -	\$ 508,250	\$ 928,911	\$ 6,644,023	
2021	\$ 5,226,767	\$ -	\$ 508,250	\$ 941,490	\$ 6,676,507	
2022	\$ 5,246,405	\$ -	\$ 508,250	\$ 954,254	\$ 6,708,909	
2023	\$ 5,265,506	\$ -	\$ 508,250	\$ 967,755	\$ 6,740,911	
2024	\$ 5,284,235	\$ -	\$ 508,250	\$ 980,223	\$ 6,772,708	
2025	\$ 5,302,746	\$ -	\$ 508,250	\$ 993,489	\$ 6,804,485	
2026	\$ 5,320,800	\$ -	\$ 508,250	\$ 1,006,909	\$ 6,835,959	
2027	\$ 5,338,558	\$ -	\$ 508,250	\$ 1,020,514	\$ 6,867,322	
2028	\$ 5,356,170	\$ -	\$ 508,250	\$ 1,034,335	\$ 6,898,755	
2029	\$ 5,373,424	\$ -	\$ 508,250	\$ 1,048,334	\$ 6,930,008	
2030	\$ 5,390,476	\$ -	\$ 508,250	\$ 1,062,541	\$ 6,961,267	
2031	\$ 5,407,138	\$ -	\$ 508,250	\$ 1,076,922	\$ 6,992,310	
2032	\$ 5,423,571	\$ -	\$ 508,250	\$ 1,091,509	\$ 7,023,330	
2033	\$ 5,439,608	\$ -	\$ 508,250	\$ 1,106,272	\$ 7,054,130	
2034	\$ 5,455,410	\$ -	\$ 508,250	\$ 1,121,244	\$ 7,084,904	
2035	\$ 5,470,832	\$ -	\$ 508,250	\$ 1,136,397	\$ 7,115,479	
2036	\$ 5,486,036	\$ -	\$ 508,250	\$ 1,151,765	\$ 7,146,051	
2037	\$ 5,500,890	\$ -	\$ 508,250	\$ 1,167,323	\$ 7,176,463	
2038	\$ 5,515,557	\$ -	\$ 508,250	\$ 1,183,108	\$ 7,206,915	
2039	\$ 5,529,919	\$ -	\$ 508,250	\$ 1,199,096	\$ 7,237,265	
2040	\$ 5,544,136	\$ -	\$ 508,250	\$ 1,215,323	\$ 7,267,709	

Calculated by ECONorthwest based on the following sources:
 ODOT Long-Range Revenue Tables 2013 v3.
 City of Bend, Oregon 2013-2015; Page 223
 City of Bend Transportation Operations Forecast, January 2014

Exhibit 8 shows the same long-term forecast of City revenues for transportation operations, maintenance and administration, but in nominal YOE dollars.

Exhibit 8. Projected annual revenue sources available for transportation operation and maintenance and administration, City of Bend, FYE 2015 to 2040 (YOE \$)

FYE	Revenue for O & M and Administration				Total for O & M and admin
	State Highway Fund	General Fund	Garbage Franchise Fees	Other	
2015	\$ 5,102,633	\$ 3,000,000	\$ 508,250	\$ 868,610	\$ 9,479,493
2016	\$ 5,283,153	\$ 3,000,000	\$ 524,006	\$ 907,653	\$ 9,714,812
2017	\$ 5,469,561	\$ 3,000,000	\$ 540,270	\$ 948,451	\$ 9,958,282
2018	\$ 5,662,041	\$ 3,000,000	\$ 557,042	\$ 991,083	\$ 10,210,166
2019	\$ 5,860,786	\$ 3,000,000	\$ 574,323	\$ 1,035,631	\$ 10,470,740
2020	\$ 6,065,994	\$ -	\$ 592,111	\$ 1,082,181	\$ 7,740,286
2021	\$ 6,277,870	\$ -	\$ 610,459	\$ 1,130,824	\$ 8,019,153
2022	\$ 6,496,632	\$ -	\$ 629,366	\$ 1,181,653	\$ 8,307,642
2023	\$ 6,722,472	\$ -	\$ 648,883	\$ 1,234,767	\$ 8,606,122
2024	\$ 6,955,639	\$ -	\$ 669,009	\$ 1,290,268	\$ 8,914,916
2025	\$ 7,196,357	\$ -	\$ 689,746	\$ 1,348,264	\$ 9,234,367
2026	\$ 7,444,864	\$ -	\$ 711,143	\$ 1,408,867	\$ 9,564,874
2027	\$ 7,701,404	\$ -	\$ 733,201	\$ 1,472,194	\$ 9,906,799
2028	\$ 7,966,232	\$ -	\$ 755,920	\$ 1,538,367	\$ 10,260,519
2029	\$ 8,239,609	\$ -	\$ 779,351	\$ 1,607,515	\$ 10,626,475
2030	\$ 8,521,804	\$ -	\$ 803,492	\$ 1,679,771	\$ 11,005,067
2031	\$ 8,813,095	\$ -	\$ 828,397	\$ 1,755,275	\$ 11,396,767
2032	\$ 9,113,768	\$ -	\$ 854,063	\$ 1,834,172	\$ 11,802,003
2033	\$ 9,424,120	\$ -	\$ 880,543	\$ 1,916,616	\$ 12,221,279
2034	\$ 9,744,454	\$ -	\$ 907,836	\$ 2,002,766	\$ 12,655,056
2035	\$ 10,075,085	\$ -	\$ 935,993	\$ 2,092,788	\$ 13,103,866
2036	\$ 10,416,336	\$ -	\$ 965,014	\$ 2,186,856	\$ 13,568,206
2037	\$ 10,768,543	\$ -	\$ 994,950	\$ 2,286,152	\$ 14,048,645
2038	\$ 11,132,048	\$ -	\$ 1,025,801	\$ 2,387,867	\$ 14,545,716
2039	\$ 11,507,209	\$ -	\$ 1,057,617	\$ 2,495,199	\$ 15,060,025
2040	\$ 11,894,390	\$ -	\$ 1,090,400	\$ 2,607,355	\$ 15,592,145

Calculated by ECONorthwest based on the following sources:
 ODOT Long-Range Revenue Tables 2013 v3.
 City of Bend, Oregon 2013-2015; Page 223
 City of Bend Transportation Operations Forecast, January 2014

It is important to compare the forecast of City revenues for operations, maintenance and administration to a forecast of expenditures in these areas. The City of Bend spent \$9.4 million on transportation operations, maintenance and administration in FYE 2014. The City's short-term forecast of expenditures for transportation operations show relatively little change in planned annual expenditures over the next five years. These projections are shown in Exhibit 9.

Exhibit 9. Projected annual expenditures for transportation operations and maintenance and administration, City of Bend, FYE 2015 to 2019

	Actual 2012-13	Estimate 2013-14	2014-15	2015-16	Projection 2016-17	2017-18	2018-19
Personnel	\$2,627,463	\$2,813,387	\$3,116,679	\$3,257,440	\$3,268,773	\$3,334,694	\$3,508,616
Materials & Services and Debt	\$1,626,162	\$2,046,751	\$2,095,492	\$2,144,402	\$2,193,790	\$2,218,666	\$2,244,039
Capital	\$3,430,887	\$2,803,100	\$2,445,000	\$2,175,000	\$2,175,000	\$2,175,000	\$2,175,000
Interfund Transfers	\$1,472,195	\$1,770,700	\$1,891,650	\$1,977,309	\$1,839,409	\$1,867,099	\$1,918,509
Total Expenditures	\$9,156,707	\$9,433,938	\$9,548,821	\$9,554,151	\$9,476,972	\$9,595,459	\$9,846,164

Source: City of Bend Transportation Operations Forecast, January 2014.

Exhibit 10 compares annual revenues with expenditures for the City of Bend for transportation operations, maintenance and administration. In all years except for FYE 2015, the City is forecast to have more than enough revenue to cover the anticipated expenditures. Note that the small “deficit” that appears in FYE 2015 is not a cause for concern, as the City has a beginning fund balance of \$2.4 million in FYE 2015 that is not reflected in the table below. Note that the long-term forecast of expenditures uses the City’s short-term forecast through FYE 2019, then reduces that amount by \$3,000,000 (YOE \$) in FYE 2020, to reflect the reduction in City general fund subsidy. For all future years, annual expenditures are expected to remain virtually constant in constant 2015 dollars, with growth equal to the anticipated rate of inflation.

Exhibit 10. Projected annual revenues and expenditures for transportation operations and maintenance and administration, City of Bend, FYE 2015 to 2040

FYE	YOE \$			Constant 2015 \$		
	Revenues	Expenditures	Surplus (Deficit)	Revenues	Expenditures	Surplus (Deficit)
2015	\$ 9,479,493	\$ 9,548,821	\$ (69,328)	\$ 9,479,493	\$ 9,548,821	\$ (69,328)
2016	\$ 9,714,812	\$ 9,554,151	\$ 160,661	\$ 9,422,708	\$ 9,266,878	\$ 155,830
2017	\$ 9,958,282	\$ 9,476,972	\$ 481,310	\$ 9,368,092	\$ 8,915,308	\$ 452,784
2018	\$ 10,210,166	\$ 9,595,459	\$ 614,707	\$ 9,315,845	\$ 8,754,981	\$ 560,864
2019	\$ 10,470,740	\$ 9,846,164	\$ 624,576	\$ 9,266,141	\$ 8,713,419	\$ 552,722
2020	\$ 7,740,286	\$ 7,058,395	\$ 681,891	\$ 6,644,023	\$ 6,058,708	\$ 585,315
2021	\$ 8,019,153	\$ 7,277,205	\$ 741,948	\$ 6,676,507	\$ 6,058,784	\$ 617,723
2022	\$ 8,307,642	\$ 7,502,798	\$ 804,844	\$ 6,708,909	\$ 6,058,950	\$ 649,959
2023	\$ 8,606,122	\$ 7,735,385	\$ 870,737	\$ 6,740,911	\$ 6,058,890	\$ 682,021
2024	\$ 8,914,916	\$ 7,975,182	\$ 939,734	\$ 6,772,708	\$ 6,058,788	\$ 713,920
2025	\$ 9,234,367	\$ 8,222,413	\$ 1,011,954	\$ 6,804,485	\$ 6,058,811	\$ 745,674
2026	\$ 9,567,874	\$ 8,477,308	\$ 1,087,566	\$ 6,835,959	\$ 6,058,682	\$ 777,277
2027	\$ 9,906,799	\$ 8,740,105	\$ 1,166,694	\$ 6,867,322	\$ 6,058,578	\$ 808,744
2028	\$ 10,260,519	\$ 9,011,048	\$ 1,249,471	\$ 6,898,755	\$ 6,058,662	\$ 840,093
2029	\$ 10,626,475	\$ 9,290,390	\$ 1,336,085	\$ 6,930,008	\$ 6,058,687	\$ 871,321
2030	\$ 11,005,067	\$ 9,578,392	\$ 1,426,675	\$ 6,961,267	\$ 6,058,822	\$ 902,445
2031	\$ 11,396,767	\$ 9,875,322	\$ 1,521,445	\$ 6,992,310	\$ 6,058,851	\$ 933,459
2032	\$ 11,802,003	\$ 10,191,457	\$ 1,620,546	\$ 7,023,330	\$ 6,058,948	\$ 964,382
2033	\$ 12,221,279	\$ 10,497,082	\$ 1,724,197	\$ 7,054,130	\$ 6,058,922	\$ 995,208
2034	\$ 12,655,056	\$ 10,822,492	\$ 1,832,564	\$ 7,084,904	\$ 6,058,947	\$ 1,025,957
2035	\$ 13,103,866	\$ 11,157,989	\$ 1,945,877	\$ 7,115,479	\$ 6,058,856	\$ 1,056,623
2036	\$ 13,568,206	\$ 11,503,887	\$ 2,064,319	\$ 7,146,051	\$ 6,058,823	\$ 1,087,228
2037	\$ 14,048,645	\$ 11,860,507	\$ 2,188,138	\$ 7,176,463	\$ 6,058,698	\$ 1,117,765
2038	\$ 14,545,716	\$ 12,228,183	\$ 2,317,533	\$ 7,206,915	\$ 6,058,655	\$ 1,148,260
2039	\$ 15,060,025	\$ 12,607,257	\$ 2,452,768	\$ 7,237,265	\$ 6,058,560	\$ 1,178,705
2040	\$ 15,592,145	\$ 12,998,082	\$ 2,594,063	\$ 7,267,709	\$ 6,058,582	\$ 1,209,127

Calculated by ECONorthwest based on the following sources:
 ODOT Long-Range Revenue Tables 2013 v3.
 City of Bend, Oregon 2013-2015; Page 223
 City of Bend Transportation Operations Forecast, January 2014

Capital projects

The revenue available to the City of Bend for transportation capital projects has varied over the past three most recent biennia, as shown in Exhibit 11. Total resources dropped from \$16.7 million in 2009-11 to \$12.7 million in 2011-2013, and then increased to \$17.2 million in 2013-2015. The largest source of revenue has been Systems Development Charges (SDCs), accounting for anywhere from one-third to three-quarters of revenue, excluding beginning working capital (i.e. carryover from previous years). Other notable funding sources for transportation capital projects include intergovernmental revenues (primarily federal STP allocations) and water/sewer franchise fees.

**Exhibit 11. Historical transportation capital revenue sources for the City of Bend,
Biennium 2009-11 to 2013-15 (YOE dollars)**

	Actual 2009-11	Adjusted 2011-13	Adopted 2013-15
Resources			
Beginning Working Capital	\$ 5,895,902	\$ 5,798,000	\$ 9,023,700
Franchise Fees	\$ 1,698,970	\$ 1,997,700	\$ 1,147,500
Intergovernmental Revenues	\$ 630,902	\$ 1,660,250	\$ 767,500
Interfund Transfers:			
SDC Fund	\$ 3,568,428	\$ 3,041,050	\$ 6,008,600
Other	\$ 71,586	\$ 50,600	\$ 12,400
Contributions	\$ 132,053	\$ -	\$ -
Investment Income	\$ 103,747	\$ 54,500	\$ 66,300
Miscellaneous	\$ 58,085	\$ 44,400	\$ 24,800
Sale of Capital Assets	\$ 211,134	\$ -	\$ 120,000
Issuance of Long-Term Debt	\$ 4,263,303	\$ -	\$ -
Loan Repayments	\$ 27,214	\$ 17,500	\$ 6,800
<i>Total Resources</i>	<i>\$ 16,658,324</i>	<i>\$ 12,664,000</i>	<i>\$ 17,177,600</i>

Sources:

City of Bend, Oregon 2013-2015 2013 Adopted Biennial Budget; Page 229

City of Bend, Oregon 2011-2013 Adopted Biennial Budget; Page 171

In FYE 2015 the BMPO is expected to receive approximately \$1.0 million in STP revenue. Total federal highway funds going to Oregon are expected to grow over the forecast period and subsequently so is the amount of federal funds allocated to the BMPO, as shown in Exhibit 12. However, this growth is not anticipated to keep pace with inflation, resulting in declining revenues as measured in constant 2015 dollars.

Exhibit 12. Projected annual allocation of STP revenues to the Bend MPO, FYE 2015 to 2040

FYE	YOE \$			Constant 2015 \$		
	Total Federal Hwy Funds to Oregon	STP Allocation to Small Cities	STP to Bend MPO	Total Federal Hwy Funds to Oregon	STP Allocation to Small Cities	STP to Bend MPO
2015	\$ 497,544,000	\$ 10,905,000	\$ 999,007	\$ 497,544,000	\$ 10,905,000	\$ 999,007
2016	\$ 504,510,000	\$ 11,058,000	\$ 1,012,993	\$ 489,340,446	\$ 10,725,509	\$ 982,534
2017	\$ 511,573,000	\$ 11,213,000	\$ 1,027,175	\$ 481,253,998	\$ 10,548,448	\$ 966,298
2018	\$ 518,735,000	\$ 11,370,000	\$ 1,041,555	\$ 473,298,358	\$ 10,374,088	\$ 950,324
2019	\$ 525,997,000	\$ 11,529,000	\$ 1,056,137	\$ 465,484,071	\$ 10,202,655	\$ 934,634
2020	\$ 593,412,000	\$ 11,690,000	\$ 1,070,923	\$ 509,366,524	\$ 10,034,335	\$ 919,247
2021	\$ 540,828,000	\$ 11,854,000	\$ 1,085,916	\$ 450,277,246	\$ 9,869,286	\$ 904,101
2022	\$ 548,400,000	\$ 12,020,000	\$ 1,101,118	\$ 442,865,218	\$ 9,706,856	\$ 889,218
2023	\$ 556,077,000	\$ 12,188,000	\$ 1,116,534	\$ 435,558,079	\$ 9,546,487	\$ 874,547
2024	\$ 563,862,000	\$ 12,359,000	\$ 1,132,166	\$ 428,368,913	\$ 9,389,197	\$ 860,112
2025	\$ 571,756,000	\$ 12,532,000	\$ 1,148,016	\$ 421,307,199	\$ 9,234,397	\$ 845,933
2026	\$ 651,884,000	\$ 12,707,000	\$ 1,164,088	\$ 465,897,656	\$ 9,081,618	\$ 831,967
2027	\$ 587,878,000	\$ 12,885,000	\$ 1,180,385	\$ 407,512,824	\$ 8,931,790	\$ 818,235
2028	\$ 596,108,000	\$ 13,065,000	\$ 1,196,911	\$ 400,798,763	\$ 8,784,374	\$ 804,754
2029	\$ 604,454,000	\$ 13,248,000	\$ 1,213,667	\$ 394,191,992	\$ 8,639,624	\$ 791,488
2030	\$ 612,916,000	\$ 13,434,000	\$ 1,230,659	\$ 387,700,677	\$ 8,497,691	\$ 778,455
2031	\$ 621,497,000	\$ 13,622,000	\$ 1,247,888	\$ 381,309,896	\$ 8,357,568	\$ 765,622
2032	\$ 716,819,000	\$ 13,813,000	\$ 1,265,358	\$ 426,576,410	\$ 8,220,067	\$ 753,010
2033	\$ 639,020,000	\$ 14,006,000	\$ 1,283,073	\$ 368,842,713	\$ 8,084,271	\$ 740,591
2034	\$ 647,967,000	\$ 14,202,000	\$ 1,301,036	\$ 362,762,849	\$ 7,950,957	\$ 728,382
2035	\$ 657,038,000	\$ 14,401,000	\$ 1,319,251	\$ 356,775,630	\$ 7,819,831	\$ 716,361
2036	\$ 666,237,000	\$ 14,602,000	\$ 1,337,721	\$ 350,891,136	\$ 7,690,525	\$ 704,545
2037	\$ 675,564,000	\$ 14,807,000	\$ 1,356,449	\$ 345,098,079	\$ 7,563,854	\$ 692,914
2038	\$ 789,057,000	\$ 15,014,000	\$ 1,375,439	\$ 390,951,296	\$ 7,438,934	\$ 681,484
2039	\$ 694,612,000	\$ 15,224,000	\$ 1,394,695	\$ 333,803,643	\$ 7,316,065	\$ 670,236
2040	\$ 704,337,000	\$ 15,437,000	\$ 1,414,221	\$ 328,301,016	\$ 7,195,395	\$ 659,187

Source: ODOT Long-Range Revenue Tables 2013 v3. Summarized by ECONorthwest.

Exhibit 13 shows a forecast of future transportation SDC revenues for the City of Bend. SDC rates per peak hour trip (PHT) are forecast to increase over time. The rates from FYE 2015 to 2032 were provided by the City of Bend's Transportation System Plan (TSP) revenue forecasts, updated in 2013. For years 2033 to 2040, we forecast the SDC rates to grow at the average annual growth rate reflected in the City's TSP forecast. DKS forecast total PHTs in the year 2040 to be 73,825, compared to 52,318 reported PHTs in the year 2010. The annual projection of new PHTs was calculated by ECONorthwest, assuming a constant rate of growth from 2010 to 2040 (1.39% per year). SDC revenues are forecast to increase from \$3.4 million in FYE 2015 to \$12.3 million in FYE 2040 (YOE \$). Even after adjusting for inflation and presenting the numbers in constant 2015 dollars, SDC revenues are still expected to increase by 70% over the forecast period.

Exhibit 13. Projected annual transportation SDC revenue, City of Bend, FYE 2015 to 2040

FYE	YOE \$			Constant 2015 \$		
	SDC (\$/PHT)	PHT	SDC Revenue	SDC (\$/PHT)	PHT	SDC Revenue
2015	\$ 4,713	716	\$ 3,374,524	\$ 4,713	716	\$ 3,374,524
2016	\$ 4,807	726	\$ 3,490,087	\$ 4,663	726	\$ 9,985,147
2017	\$ 5,067	736	\$ 3,729,100	\$ 4,766	736	\$ 3,508,090
2018	\$ 5,340	746	\$ 3,983,747	\$ 4,872	746	\$ 3,634,806
2019	\$ 5,628	756	\$ 4,255,017	\$ 4,981	756	\$ 3,765,502
2020	\$ 5,741	767	\$ 4,406,267	\$ 4,928	767	\$ 3,779,628
2021	\$ 5,856	777	\$ 4,549,889	\$ 4,875	777	\$ 3,788,102
2022	\$ 6,172	788	\$ 4,863,318	\$ 4,984	788	\$ 3,927,415
2023	\$ 6,505	799	\$ 5,197,624	\$ 5,095	799	\$ 4,070,905
2024	\$ 6,856	810	\$ 5,553,217	\$ 5,208	810	\$ 4,218,808
2025	\$ 6,993	821	\$ 5,741,204	\$ 5,153	821	\$ 4,230,494
2026	\$ 7,133	833	\$ 5,941,621	\$ 5,098	833	\$ 4,246,442
2027	\$ 7,481	844	\$ 6,313,859	\$ 5,186	844	\$ 4,376,722
2028	\$ 7,849	856	\$ 6,716,123	\$ 5,175	856	\$ 4,515,648
2029	\$ 8,229	868	\$ 7,142,613	\$ 5,366	868	\$ 4,658,023
2030	\$ 8,352	880	\$ 7,349,979	\$ 5,283	880	\$ 4,649,237
2031	\$ 8,519	892	\$ 7,599,210	\$ 5,227	892	\$ 4,662,378
2032	\$ 8,979	904	\$ 8,117,057	\$ 5,343	904	\$ 4,830,431
2033	\$ 9,326	917	\$ 8,551,942	\$ 5,383	917	\$ 4,936,186
2034	\$ 9,686	930	\$ 9,007,980	\$ 5,423	930	\$ 5,043,097
2035	\$ 10,060	943	\$ 9,486,580	\$ 5,463	943	\$ 5,151,271
2036	\$ 10,449	956	\$ 9,989,244	\$ 5,503	956	\$ 5,261,097
2037	\$ 10,853	969	\$ 10,516,557	\$ 5,544	969	\$ 5,372,168
2038	\$ 11,272	982	\$ 11,069,104	\$ 5,585	982	\$ 5,484,370
2039	\$ 11,708	996	\$ 11,661,168	\$ 5,626	996	\$ 5,603,906
2040	\$ 12,160	1,011	\$ 12,293,760	\$ 5,668	1,011	\$ 5,730,288

Calculated by ECONorthwest based on the following sources:

City of Bend Transportation System Plan, Revised Funding for Transportation Improvements 2003-2032.

PHT forecast provided by DKS

Note: PHT refers to "Peak Hour Trips"

Exhibit 14 shows a forecast of annual water/sewer franchise fee revenues for the City of Bend. Historically, 100% of these revenues have been allocated to transportation capital projects, although in the most recent fiscal year, 2014-15, the City deviated from past practices and allocated 50% of these SDC revenues to accessibility projects. Conversations with the City's interim finance director suggest that long-term forecasts should assume that the City acts in accordance with historical practices, and allocates 100% of these franchise fee revenues to transportation capital projects.

The City's TSP revenue forecasts, updated in 2013, project future rate increases for water/sewer customers, as well as future changes in consumption. Those projections only extend through FYE 2032, after which time, we forecast future franchise fee revenues based on the average annual growth rate of the TSP forecast period (3.0% per year in YOE \$). Ultimately, this long-term forecast results in small annual fluctuations, but almost no long-term change in annual funding in constant 2015 dollars.

Annual water/sewer franchise fee revenues are expected to remain at approximately \$1.1 to \$1.2 million (constant 2015 \$) for the duration of the forecast period.

Exhibit 14. Projected annual water/sewer franchise fee revenue available for transportation projects, City of Bend, FYE 2015 to 2040

Year					Water/Sewer Franchise Fees	
	% Change in rate		% Change in consumption		YOE \$	Constant 2015 \$
2015	6.0	%	0.0	%	\$ 1,175,398	\$ 1,175,398
2016	6.0	%	0.0	%	\$ 1,245,922	\$ 1,208,460
2017	6.0	%	0.5	%	\$ 1,327,281	\$ 1,248,618
2018	6.0	%	0.5	%	\$ 1,373,935	\$ 1,253,590
2019	6.0	%	0.5	%	\$ 1,422,229	\$ 1,258,610
2020	3.0	%	0.5	%	\$ 1,472,220	\$ 1,263,708
2021	3.0	%	1.0	%	\$ 1,531,550	\$ 1,275,123
2022	3.0	%	1.0	%	\$ 1,593,271	\$ 1,286,660
2023	2.0	%	1.0	%	\$ 1,641,388	\$ 1,285,649
2024	2.0	%	1.0	%	\$ 1,690,958	\$ 1,284,630
2025	2.0	%	0.0	%	\$ 1,724,777	\$ 1,270,928
2026	2.0	%	0.0	%	\$ 1,759,273	\$ 1,257,342
2027	2.0	%	-2.0	%	\$ 1,758,569	\$ 1,219,027
2028	2.0	%	-1.0	%	\$ 1,775,803	\$ 1,193,978
2029	2.0	%	0.0	%	\$ 1,811,319	\$ 1,181,244
2030	2.0	%	0.0	%	\$ 1,847,545	\$ 1,168,667
2031	2.0	%	0.5	%	\$ 1,893,918	\$ 1,161,984
2032	2.0	%	0.5	%	\$ 1,941,455	\$ 1,155,353
2033					\$ 1,999,620	\$ 1,154,182
2034					\$ 2,059,528	\$ 1,153,022
2035					\$ 2,121,230	\$ 1,151,841
2036					\$ 2,184,781	\$ 1,150,672
2037					\$ 2,250,236	\$ 1,149,487
2038					\$ 2,317,652	\$ 1,148,319
2039					\$ 2,387,088	\$ 1,147,142
2040					\$ 2,458,604	\$ 1,145,989

Calculated by ECONorthwest based on City of Bend Transportation System Plan, Revised Funding for Transportation Improvements 2003-2032.

Other funding sources for the City of Bend's transportation capital projects include:

- **Private contributions** from developers for non-creditable improvements. These contributions fluctuate significantly over time, but are forecast in the City's TSP revenue projections to stay at a constant level of \$50,000 per year. Conversations with City staff indicate that this \$50,000 per year funding level should be considered in constant 2015 dollars, recognizing that the actual funding amount in nominal YOE dollars will increase over time with inflation. Note that this funding level appears to be conservative based on a review of historical revenue amounts, which frequently exceeded \$100,000 per year, even during the depths of the recent recession.

- **General obligation (GO) bonds** are one-time sources of additional revenue for transportation projects, approved by voters and repaid through property taxes. The City has a history of successfully passing GO bonds to pay for transportation projects, including most recently in 2012. The 2013 bonds are set to expire in 2032, at which time the City anticipates asking the voters to approve a new set of GO bond projects. The timing of the bonds are important to maximize voter support, as the new bonds can be framed as replacing the old bonds, resulting in no change in the property tax rate. The City assumes \$40 million in GO bonds would be issued in 2032, though that dollar amount is reduced to \$23.8 million in constant 2015 dollars.
- **Urban renewal** is a form of tax increment financing in which property tax revenues within a specified area are diverted to specific improvements in the area, instead of being allocated to other taxing districts. The City has two urban renewal plans in place that identify specific transportation capital projects to receive urban renewal funding. The City's TSP revenue forecasts assume a total of \$30 million in urban renewal funding for transportation projects over the course of the 2040 forecast period. This amounts to \$21.6 million in constant 2015 dollars.
- **Other** smaller revenue sources include investment income, sale of capital assets, interfund transfers, loan repayments, and other miscellaneous sources. These other sources are projected to total \$144,844 per year in FYE 2015. We forecast that these sources will increase over time based on the pace of new development (1.39% per year as measured by new PHTs), and the assumed rate of inflation (3.1% per year, as used in ODOT long-term revenue forecasts).

Exhibit 15 shows the forecast of all City funding sources for transportation capital projects through 2040, in constant 2015 dollars. Total revenues are expected to grow over time from \$5.7 million per year in FYE 2015 to \$7.8 million per year in FYE 2040. Some years show substantially higher annual funding amounts, as urban renewal, and GO bond revenues become available for transportation projects.

Exhibit 16 shows the same long-term forecast of City revenues for transportation capital projects, but in nominal YOE dollars.

**Exhibit 15. Projected annual revenue sources available for transportation capital projects,
City of Bend, FYE 2015 to 2040 (Constant 2015 \$)**

FYE	Revenue for Capital Projects							
	SDCs	Water/Sewer Franchise Fees	STP	Private Contributions	GO Bonds	Urban Renewal	Other	Total for Capital
2015	\$3,374,524	\$1,175,398	\$999,007	\$50,000	\$-	\$-	\$144,844	\$5,743,773
2016	\$3,385,147	\$1,208,460	\$982,534	\$50,000	\$-	\$-	\$146,854	\$5,772,995
2017	\$3,508,090	\$1,248,618	\$966,298	\$50,000	\$-	\$4,703,669	\$148,884	\$10,625,559
2018	\$3,634,806	\$1,253,590	\$950,324	\$50,000	\$-	\$-	\$150,943	\$6,039,663
2019	\$3,765,502	\$1,258,610	\$934,634	\$50,000	\$-	\$-	\$153,033	\$6,161,779
2020	\$3,779,628	\$1,263,708	\$919,247	\$50,000	\$-	\$-	\$155,159	\$6,167,742
2021	\$3,788,102	\$1,275,123	\$904,101	\$50,000	\$-	\$-	\$157,312	\$6,174,638
2022	\$3,927,415	\$1,286,660	\$889,218	\$50,000	\$-	\$-	\$159,499	\$6,312,792
2023	\$4,070,905	\$1,285,649	\$874,547	\$50,000	\$-	\$-	\$161,709	\$6,442,810
2024	\$4,218,808	\$1,284,630	\$860,112	\$50,000	\$-	\$3,798,526	\$163,949	\$10,376,025
2025	\$4,230,494	\$1,270,928	\$845,933	\$50,000	\$-	\$-	\$166,224	\$6,563,579
2026	\$4,246,442	\$1,257,342	\$831,967	\$50,000	\$-	\$-	\$168,525	\$6,554,276
2027	\$4,376,722	\$1,219,027	\$818,235	\$50,000	\$-	\$-	\$170,859	\$6,634,843
2028	\$4,515,648	\$1,193,978	\$804,754	\$50,000	\$-	\$6,723,593	\$173,231	\$13,461,204
2029	\$4,658,023	\$1,181,244	\$791,488	\$50,000	\$-	\$-	\$175,634	\$6,856,389
2030	\$4,649,237	\$1,168,667	\$778,455	\$50,000	\$-	\$6,325,511	\$178,074	\$13,149,944
2031	\$4,662,378	\$1,161,984	\$765,622	\$50,000	\$-	\$-	\$180,544	\$6,820,528
2032	\$4,830,431	\$1,155,353	\$753,010	\$50,000	\$23,803,856	\$-	\$183,051	\$30,775,701
2033	\$4,936,186	\$1,154,182	\$740,591	\$50,000	\$-	\$-	\$185,589	\$7,066,548
2034	\$5,043,097	\$1,153,022	\$728,382	\$50,000	\$-	\$-	\$188,164	\$7,162,665
2035	\$5,151,271	\$1,151,841	\$716,361	\$50,000	\$-	\$-	\$190,771	\$7,260,244
2036	\$5,261,097	\$1,150,672	\$704,545	\$50,000	\$-	\$-	\$193,415	\$7,359,729
2037	\$5,372,168	\$1,149,487	\$692,914	\$50,000	\$-	\$-	\$196,093	\$7,460,662
2038	\$5,484,370	\$1,148,319	\$681,484	\$50,000	\$-	\$-	\$198,811	\$7,562,984
2039	\$5,603,906	\$1,147,142	\$670,236	\$50,000	\$-	\$-	\$201,565	\$7,672,849
2040	\$5,730,288	\$1,145,989	\$659,187	\$50,000	\$-	\$-	\$204,361	\$7,789,825

Calculated by ECONorthwest based on the following sources:
City of Bend, Oregon 2013-2015 2013 Adopted Biennial Budget; Page 229
ODOT Long-Range Revenue Tables 2013 v3. Summarized by ECONorthwest.
PHT forecast provided by DKS
City of Bend Transportation System Plan Revised Funding for Transportation Improvements 2003-2032.

**Exhibit 16. Projected annual revenue sources available for transportation capital projects,
City of Bend, FYE 2015 to 2040 (YOE \$)**

FYE	Revenue for Capital Projects							Total for Capital
	SDCs	Water/Sewer Franchise Fees	STP	Private Contributions	GO Bonds	Urban Renewal	Other	
2015	\$3,374,524	\$ 1,175,398	\$999,007	\$50,000	\$-	\$-	\$144,844	\$5,743,773
2016	\$3,490,087	\$ 1,245,922	\$1,012,993	\$51,550	\$-	\$-	\$151,406	\$5,951,958
2017	\$3,729,100	\$ 1,327,281	\$1,027,175	\$53,150	\$-	\$5,000,000	\$158,264	\$11,294,970
2018	\$3,983,747	\$ 1,373,935	\$1,041,555	\$54,800	\$-	\$-	\$165,433	\$6,619,470
2019	\$4,255,017	\$ 1,422,229	\$1,056,137	\$56,500	\$-	\$-	\$172,927	\$6,962,810
2020	\$4,403,267	\$ 1,472,220	\$1,070,923	\$58,250	\$-	\$-	\$180,760	\$7,185,420
2021	\$4,549,889	\$ 1,531,550	\$1,085,916	\$60,055	\$-	\$-	\$188,948	\$7,416,358
2022	\$4,863,318	\$ 1,593,271	\$1,101,118	\$61,915	\$-	\$-	\$197,507	\$7,817,129
2023	\$5,197,324	\$ 1,641,388	\$1,116,534	\$63,835	\$-	\$-	\$206,454	\$8,225,535
2024	\$5,553,217	\$ 1,690,958	\$1,132,166	\$65,815	\$-	\$5,000,000	\$215,806	\$13,657,962
2025	\$5,741,204	\$ 1,724,777	\$1,148,016	\$67,855	\$-	\$-	\$225,582	\$8,907,434
2026	\$5,941,621	\$ 1,759,273	\$1,164,088	\$69,960	\$-	\$-	\$235,800	\$9,170,742
2027	\$6,313,859	\$ 1,758,569	\$1,180,385	\$72,130	\$-	\$-	\$246,481	\$9,571,424
2028	\$6,716,123	\$1,775,803	\$1,196,911	\$74,365	\$-	\$10,000,000	\$257,646	\$20,020,848
2029	\$7,142,613	\$1,811,319	\$1,213,667	\$76,670	\$-	\$-	\$269,317	\$10,513,586
2030	\$7,349,979	\$1,847,545	\$1,230,659	\$79,045	\$-	\$10,000,000	\$281,517	\$20,788,745
2031	\$7,599,210	\$1,893,918	\$1,247,888	\$81,495	\$-	\$-	\$294,269	\$11,116,780
2032	\$8,117,057	\$1,941,455	\$1,265,358	\$84,020	\$40,000,000	\$-	\$307,599	\$51,715,489
2033	\$8,551,942	\$1,999,620	\$1,286,073	\$86,625	\$-	\$-	\$321,533	\$12,242,793
2034	\$9,007,980	\$2,059,528	\$1,301,036	\$89,310	\$-	\$-	\$336,098	\$12,793,952
2035	\$9,486,580	\$2,121,230	\$1,319,251	\$92,080	\$-	\$-	\$351,323	\$13,370,464
2036	\$9,989,244	\$2,184,781	\$1,337,721	\$94,935	\$-	\$-	\$367,237	\$13,973,918
2037	\$10,516,557	\$2,250,236	\$1,356,449	\$97,880	\$-	\$-	\$383,872	\$14,604,994
2038	\$11,069,104	\$2,317,652	\$1,375,439	\$100,915	\$-	\$-	\$401,261	\$15,264,371
2039	\$11,661,168	\$2,387,088	\$1,394,695	\$104,045	\$-	\$-	\$419,437	\$15,966,433
2040	\$12,293,760	\$2,458,604	\$1,414,221	\$107,270	\$-	\$-	\$438,437	\$16,712,292

Calculated by ECONorthwest based on the following sources:
City of Bend, Oregon 2013-2015 2013 Adopted Biennial Budget; Page 229
ODOT Long-Range Revenue Tables 2013 v3. Summarized by ECONorthwest.
PHT forecast provided by DKS
City of Bend Transportation System Plan Revised Funding for Transportation Improvements 2003-2032.

Summary of City revenue projections

Today, City revenues for transportation operations, maintenance, and administration (\$9.5 million in FYE 2015) exceed revenues for capital projects (\$5.7 million in FYE 2015). Over time, funding for operations, maintenance, and administration is expected to decrease, as the City's general fund subsidy is discontinued, and as other funds for transportation operations experience slow growth. Funding for transportation capital projects, on the other hand, is forecast to experience rather significant growth over time, fueled predominantly by growth in SDC revenue from new development, as well as period injections of one-time funds from GO bonds and urban renewal. Thus, in the later years of the forecast period, funding for capital projects is expected to exceed funding for operations. These summary numbers are shown in Exhibit 17 in constant 2015 dollars.

Exhibit 17. Summary of projected annual revenue sources available for transportation, City of Bend, FYE 2015 to 2040 (Constant 2015 \$)

FYE	O&M and Administration	Capital Projects	Total
2015	\$ 9,479,493	\$ 5,743,773	\$ 15,223,266
2016	\$ 9,423,002	\$ 5,772,995	\$ 15,195,997
2017	\$ 9,368,688	\$ 10,625,559	\$ 19,994,247
2018	\$ 9,316,752	\$ 6,039,663	\$ 15,356,415
2019	\$ 9,267,366	\$ 6,161,779	\$ 15,429,145
2020	\$ 6,645,576	\$ 6,167,742	\$ 12,813,318
2021	\$ 6,678,397	\$ 6,174,638	\$ 12,853,035
2022	\$ 6,711,145	\$ 6,312,792	\$ 13,023,937
2023	\$ 6,743,501	\$ 6,442,810	\$ 13,186,311
2024	\$ 6,775,661	\$ 10,376,025	\$ 17,151,686
2025	\$ 6,807,811	\$ 6,563,579	\$ 13,371,390
2026	\$ 6,839,667	\$ 6,554,276	\$ 13,393,943
2027	\$ 6,871,423	\$ 6,634,843	\$ 13,506,266
2028	\$ 6,903,260	\$ 13,461,204	\$ 20,364,464
2029	\$ 6,934,925	\$ 6,856,389	\$ 13,791,314
2030	\$ 6,966,608	\$ 13,149,944	\$ 20,116,552
2031	\$ 6,998,084	\$ 6,820,528	\$ 13,818,612
2032	\$ 7,029,550	\$ 30,775,701	\$ 37,805,251
2033	\$ 7,060,806	\$ 7,066,548	\$ 14,127,354
2034	\$ 7,092,047	\$ 7,162,665	\$ 14,254,712
2035	\$ 7,123,101	\$ 7,260,244	\$ 14,383,345
2036	\$ 7,154,164	\$ 7,359,729	\$ 14,513,893
2037	\$ 7,185,079	\$ 7,460,662	\$ 14,645,741
2038	\$ 7,216,046	\$ 7,562,984	\$ 14,779,030
2039	\$ 7,246,923	\$ 7,672,849	\$ 14,919,772
2040	\$ 7,277,908	\$ 7,789,825	\$ 15,067,733

Calculated by ECONorthwest.

Exhibit 18 shows the same summary forecast of City revenues for transportation, but in nominal YOE dollars.

Exhibit 18. Summary of projected annual revenue sources available for transportation,
City of Bend, FYE 2015 to 2040 (YOE \$)

FYE	O&M and Administration	Capital Projects	Total
2015	\$ 9,479,493	\$ 5,743,773	\$ 15,223,266
2016	\$ 9,715,115	\$ 5,951,958	\$ 15,667,073
2017	\$ 9,958,916	\$ 11,294,970	\$ 21,253,886
2018	\$ 10,211,160	\$ 6,619,470	\$ 16,830,630
2019	\$ 10,472,125	\$ 6,962,810	\$ 17,434,935
2020	\$ 7,742,096	\$ 7,185,420	\$ 14,927,516
2021	\$ 8,021,423	\$ 7,416,358	\$ 15,437,781
2022	\$ 8,310,410	\$ 7,817,129	\$ 16,127,539
2023	\$ 8,609,428	\$ 8,225,535	\$ 16,834,963
2024	\$ 8,918,803	\$ 13,657,962	\$ 22,576,765
2025	\$ 9,238,881	\$ 8,907,434	\$ 18,146,315
2026	\$ 9,570,063	\$ 9,170,742	\$ 18,740,805
2027	\$ 9,912,715	\$ 9,571,424	\$ 19,484,139
2028	\$ 10,267,218	\$ 20,020,848	\$ 30,288,066
2029	\$ 10,634,015	\$ 10,513,586	\$ 21,147,601
2030	\$ 11,013,510	\$ 20,788,745	\$ 31,802,255
2031	\$ 11,406,179	\$ 11,116,780	\$ 22,522,959
2032	\$ 11,812,455	\$ 51,715,489	\$ 63,527,944
2033	\$ 12,232,845	\$ 12,242,793	\$ 24,475,638
2034	\$ 12,667,815	\$ 12,793,952	\$ 25,461,767
2035	\$ 13,117,903	\$ 13,370,464	\$ 26,488,367
2036	\$ 13,853,610	\$ 13,973,918	\$ 27,557,528
2037	\$ 14,065,511	\$ 14,604,994	\$ 28,670,505
2038	\$ 14,564,144	\$ 15,264,371	\$ 29,828,515
2039	\$ 15,080,122	\$ 15,966,433	\$ 31,046,555
2040	\$ 15,614,024	\$ 16,712,292	\$ 32,326,316

Source: Calculated by ECONorthwest.

Oregon Department of Transportation

The State of Oregon provides substantial funding for transportation through the Oregon Department of Transportation (ODOT). Much of the State funding for transportation is allocated to local jurisdictions to be spent by cities and counties on transportation projects. These allocations to local jurisdictions are captured under the subsections of this chapter for the City of Bend and Deschutes County, and we do not show these

pass-through revenues here, to avoid double counting. Instead, we only describe those State revenues that are spent directly by the State on transportation projects.

Exhibit 19 shows ODOT projections for total revenue available for highway projects, including both capital projects as well as operations, maintenance and administration. The projections in Exhibit 19 are net of any federal or State revenues that are passed through to local municipalities. Total revenues are projected to total \$1.0 billion in FYE 2015, and grow to \$1.8 billion in FYE 2040 (YOE \$). In constant 2015 dollars, however, this forecast shows a decline in total funding, as revenue growth is not projected to keep pace with inflation.

Exhibit 19. Projected statewide annual revenue available for highway projects, ODOT, FYE 2015 to 2040 (millions)

FYE	YOE \$			Constant 2015 \$		
	State Share of SHF	Federal Hwy Funds Available to State	Total Hwy Funds Available to State	State Share of SHF	Federal Hwy Funds Available to State	Total Hwy Funds Available to State
2015	\$ 653	\$ 359	\$ 1,012	\$ 653	\$ 359	\$ 1,012
2016	\$ 672	\$ 352	\$ 1,024	\$ 651	\$ 342	\$ 993
2017	\$ 691	\$ 357	\$ 1,048	\$ 650	\$ 336	\$ 986
2018	\$ 710	\$ 362	\$ 1,072	\$ 648	\$ 331	\$ 978
2019	\$ 730	\$ 367	\$ 1,098	\$ 646	\$ 325	\$ 971
2020	\$ 751	\$ 433	\$ 1,183	\$ 645	\$ 371	\$ 1,016
2021	\$ 772	\$ 378	\$ 1,150	\$ 643	\$ 314	\$ 957
2022	\$ 794	\$ 379	\$ 1,173	\$ 641	\$ 306	\$ 947
2023	\$ 817	\$ 384	\$ 1,201	\$ 640	\$ 301	\$ 941
2024	\$ 840	\$ 390	\$ 1,230	\$ 638	\$ 296	\$ 934
2025	\$ 864	\$ 395	\$ 1,259	\$ 637	\$ 291	\$ 928
2026	\$ 889	\$ 473	\$ 1,362	\$ 635	\$ 338	\$ 973
2027	\$ 914	\$ 406	\$ 1,320	\$ 634	\$ 282	\$ 915
2028	\$ 940	\$ 412	\$ 1,352	\$ 632	\$ 277	\$ 909
2029	\$ 967	\$ 418	\$ 1,385	\$ 631	\$ 272	\$ 903
2030	\$ 995	\$ 424	\$ 1,419	\$ 630	\$ 268	\$ 897
2031	\$ 1,024	\$ 429	\$ 1,453	\$ 628	\$ 263	\$ 892
2032	\$ 1,053	\$ 522	\$ 1,575	\$ 627	\$ 311	\$ 938
2033	\$ 1,084	\$ 442	\$ 1,525	\$ 626	\$ 255	\$ 880
2034	\$ 1,115	\$ 448	\$ 1,563	\$ 624	\$ 251	\$ 875
2035	\$ 1,147	\$ 454	\$ 1,601	\$ 623	\$ 247	\$ 869
2036	\$ 1,180	\$ 460	\$ 1,641	\$ 622	\$ 242	\$ 864
2037	\$ 1,215	\$ 467	\$ 1,681	\$ 620	\$ 238	\$ 859
2038	\$ 1,250	\$ 577	\$ 1,827	\$ 619	\$ 286	\$ 905
2039	\$ 1,286	\$ 480	\$ 1,766	\$ 618	\$ 231	\$ 849
2040	\$ 1,323	\$ 487	\$ 1,810	\$ 617	\$ 227	\$ 844

Source: ODOT Long-Range Revenue Tables 2013 v3. Summarized by ECONorthwest.

Operations and maintenance and administration

The State of Oregon is responsible for operations and maintenance of state highways. Exhibit 20 shows the State forecast for these costs through FYE 2040. In addition to preservation, maintenance, traditional operations, and central services (i.e.,

administration), Exhibit 20 also includes a column for other non-modernization highway programs. This “other” category includes the State’s Safety, ITS, and Bridge programs, as well as non-modernization related debt service, and a few other smaller programs. In total, the State forecasts \$1.08 billion in annual operating costs for FYE 2015, with an average annual growth rate of 2.6% per year.

Exhibit 20. Projected annual costs for ODOT non-modernization highway uses, FYE 2015 to 2040, millions (YOE \$)

FYE	Preservation	Maintenance	Traditional Operations	Central Services	Other	Total Non-Mod Hwy Programs
2015	\$ 220	\$ 225	\$ 32	\$ 62	\$ 540	\$ 1,079
2016	\$ 226	\$ 232	\$ 33	\$ 64	\$ 553	\$ 1,109
2017	\$ 233	\$ 240	\$ 34	\$ 66	\$ 566	\$ 1,139
2018	\$ 241	\$ 247	\$ 35	\$ 68	\$ 579	\$ 1,170
2019	\$ 248	\$ 255	\$ 36	\$ 70	\$ 593	\$ 1,202
2020	\$ 256	\$ 263	\$ 37	\$ 72	\$ 607	\$ 1,235
2021	\$ 264	\$ 271	\$ 39	\$ 75	\$ 621	\$ 1,269
2022	\$ 272	\$ 279	\$ 40	\$ 77	\$ 636	\$ 1,304
2023	\$ 280	\$ 288	\$ 41	\$ 79	\$ 652	\$ 1,340
2024	\$ 289	\$ 297	\$ 42	\$ 82	\$ 668	\$ 1,378
2025	\$ 298	\$ 306	\$ 44	\$ 84	\$ 684	\$ 1,416
2026	\$ 307	\$ 315	\$ 45	\$ 87	\$ 701	\$ 1,456
2027	\$ 317	\$ 325	\$ 46	\$ 90	\$ 719	\$ 1,497
2028	\$ 327	\$ 335	\$ 48	\$ 92	\$ 737	\$ 1,539
2029	\$ 337	\$ 346	\$ 49	\$ 95	\$ 755	\$ 1,582
2030	\$ 347	\$ 356	\$ 51	\$ 98	\$ 769	\$ 1,622
2031	\$ 358	\$ 367	\$ 52	\$ 101	\$ 789	\$ 1,668
2032	\$ 369	\$ 379	\$ 54	\$ 104	\$ 809	\$ 1,716
2033	\$ 387	\$ 391	\$ 56	\$ 108	\$ 830	\$ 1,765
2034	\$ 392	\$ 403	\$ 57	\$ 111	\$ 852	\$ 1,815
2035	\$ 404	\$ 415	\$ 59	\$ 114	\$ 874	\$ 1,868
2036	\$ 417	\$ 428	\$ 61	\$ 118	\$ 797	\$ 1,821
2037	\$ 430	\$ 441	\$ 63	\$ 122	\$ 821	\$ 1,876
2038	\$ 443	\$ 455	\$ 65	\$ 125	\$ 845	\$ 1,934
2039	\$ 457	\$ 469	\$ 67	\$ 129	\$ 871	\$ 1,993
2040	\$ 471	\$ 484	\$ 69	\$ 133	\$ 897	\$ 2,054

Source: ODOT Long-Range Revenue Tables 2013 v3. Summarized by ECONorthwest.

Exhibit 21 shows the same long-term State forecast for operating costs, but is presented in constant 2015 dollars. This table shows that total costs for non-modernization highway programs (i.e., ODOT expenditures on everything other than capital projects) are expected to increase at a rate that is less than the anticipated rate of inflation. However, this is somewhat misleading as virtually all of the State’s categories of operating expenses (Preservation, maintenance, traditional operations, central services, etc.) are expected to remain flat in constant 2015 dollars, growing at a rate equal to assumed inflation. However, one specific line-item that is not called out separately in Exhibit 21 is debt service for non-modernization projects, and these debt service expenditures are forecast to decrease over time as old debt is repaid.

**Exhibit 21. Projected annual costs for ODOT non-modernization highway uses,
FYE 2015 to 2040, millions (Constant 2015 \$)**

FYE	Preservation	Maintenance	Traditional Operations	Central Services	Other	Total Non-Mod Hwy Programs
2015	\$ 220	\$ 225	\$ 32	\$ 62	\$ 540	\$ 1,079
2016	\$ 220	\$ 225	\$ 32	\$ 62	\$ 536	\$ 1,109
2017	\$ 220	\$ 225	\$ 32	\$ 62	\$ 532	\$ 1,139
2018	\$ 220	\$ 225	\$ 32	\$ 62	\$ 528	\$ 1,170
2019	\$ 220	\$ 225	\$ 32	\$ 62	\$ 524	\$ 1,202
2020	\$ 220	\$ 225	\$ 32	\$ 62	\$ 521	\$ 1,235
2021	\$ 220	\$ 225	\$ 32	\$ 62	\$ 517	\$ 1,269
2022	\$ 220	\$ 225	\$ 32	\$ 62	\$ 514	\$ 1,304
2023	\$ 220	\$ 225	\$ 32	\$ 62	\$ 511	\$ 1,340
2024	\$ 220	\$ 225	\$ 32	\$ 62	\$ 507	\$ 1,378
2025	\$ 220	\$ 225	\$ 32	\$ 62	\$ 504	\$ 1,416
2026	\$ 220	\$ 225	\$ 32	\$ 62	\$ 501	\$ 1,456
2027	\$ 220	\$ 225	\$ 32	\$ 62	\$ 498	\$ 1,497
2028	\$ 220	\$ 225	\$ 32	\$ 62	\$ 495	\$ 1,539
2029	\$ 220	\$ 225	\$ 32	\$ 62	\$ 493	\$ 1,582
2030	\$ 220	\$ 225	\$ 32	\$ 62	\$ 487	\$ 1,622
2031	\$ 220	\$ 225	\$ 32	\$ 62	\$ 484	\$ 1,668
2032	\$ 220	\$ 225	\$ 32	\$ 62	\$ 482	\$ 1,716
2033	\$ 220	\$ 225	\$ 32	\$ 62	\$ 479	\$ 1,765
2034	\$ 220	\$ 225	\$ 32	\$ 62	\$ 477	\$ 1,815
2035	\$ 220	\$ 225	\$ 32	\$ 62	\$ 475	\$ 1,868
2036	\$ 220	\$ 225	\$ 32	\$ 62	\$ 420	\$ 1,821
2037	\$ 220	\$ 225	\$ 32	\$ 62	\$ 419	\$ 1,876
2038	\$ 220	\$ 225	\$ 32	\$ 62	\$ 419	\$ 1,934
2039	\$ 220	\$ 225	\$ 32	\$ 62	\$ 418	\$ 1,993
2040	\$ 220	\$ 225	\$ 32	\$ 62	\$ 418	\$ 2,054

Source: ODOT Long-Range Revenue Tables 2013 v3. Summarized by ECONorthwest.

Exhibit 22 compares projected ODOT costs for non-modernization highway uses (i.e., operations, maintenance, and administration) with projected ODOT revenues available for those uses. State policy generally requires operations and maintenance to be fully funded, before spending resources on capital projects. However, given the high costs for operations and maintenance and the relatively low level of revenues, this policy would result in virtually no resources available for capital projects statewide. Thus, ORS 366.507 requires that a certain portion of revenues be set aside to fund debt service and modernization projects, regardless of whether State highway funds are sufficient to cover all operations and maintenance needs. This results in a gap for non-modernization highway uses. For FYE 2015, this gap is projected to be \$175 million, which means that State highway operations and maintenance efforts are about 84% funded. Over the forecast period, this gap as a percentage of annual non-modernization needs is expected to remain fairly constant.

**Exhibit 22. Projected annual ODOT funding deficit for non-modernization highway uses,
FYE 2015 to 2040, millions (YOE \$)**

FYE	Total Hwy Revenue Available for State	Hwy Revenue Reserved for D/S and Modernization	Remaining Hwy Revenue Available for State Needs	Non-Modernization State Needs	Non-Modernization Gap	Percent Funded
2015	\$ 1,012	\$ 108	\$ 905	\$ 1,079	\$ (175)	84 %
2016	\$ 1,024	\$ 109	\$ 915	\$ 1,109	\$ (194)	83 %
2017	\$ 1,048	\$ 110	\$ 938	\$ 1,139	\$ (201)	82 %
2018	\$ 1,072	\$ 111	\$ 961	\$ 1,170	\$ (209)	82 %
2019	\$ 1,098	\$ 112	\$ 985	\$ 1,202	\$ (217)	82 %
2020	\$ 1,183	\$ 113	\$ 1,070	\$ 1,235	\$ (165)	87 %
2021	\$ 1,150	\$ 114	\$ 1,035	\$ 1,269	\$ (234)	82 %
2022	\$ 1,173	\$ 116	\$ 1,058	\$ 1,304	\$ (247)	81 %
2023	\$ 1,201	\$ 117	\$ 1,084	\$ 1,340	\$ (256)	81 %
2024	\$ 1,230	\$ 118	\$ 1,112	\$ 1,378	\$ (266)	81 %
2025	\$ 1,259	\$ 119	\$ 1,140	\$ 1,416	\$ (276)	81 %
2026	\$ 1,352	\$ 120	\$ 1,241	\$ 1,456	\$ (215)	85 %
2027	\$ 1,320	\$ 122	\$ 1,199	\$ 1,497	\$ (298)	80 %
2028	\$ 1,352	\$ 110	\$ 1,242	\$ 1,539	\$ (297)	81 %
2029	\$ 1,385	\$ 99	\$ 1,286	\$ 1,582	\$ (296)	81 %
2030	\$ 1,419	\$ 100	\$ 1,319	\$ 1,622	\$ (303)	81 %
2031	\$ 1,453	\$ 102	\$ 1,352	\$ 1,668	\$ (316)	81 %
2032	\$ 1,575	\$ 103	\$ 1,473	\$ 1,716	\$ (243)	86 %
2033	\$ 1,525	\$ 104	\$ 1,421	\$ 1,765	\$ (344)	81 %
2034	\$ 1,563	\$ 106	\$ 1,457	\$ 1,815	\$ (358)	80 %
2035	\$ 1,601	\$ 107	\$ 1,494	\$ 1,868	\$ (373)	80 %
2036	\$ 1,641	\$ 108	\$ 1,532	\$ 1,821	\$ (288)	84 %
2037	\$ 1,681	\$ 110	\$ 1,572	\$ 1,876	\$ (305)	84 %
2038	\$ 1,827	\$ 111	\$ 1,716	\$ 1,934	\$ (218)	89 %
2039	\$ 1,766	\$ 113	\$ 1,653	\$ 1,993	\$ (339)	83 %
2040	\$ 1,810	\$ 114	\$ 1,696	\$ 2,054	\$ (357)	83 %

Source: ODOT Long-Range Revenue Tables 2013 v3. Summarized by ECONorthwest.

Exhibit 23 shows the same information as Exhibit 22, but in constant 2015 dollars. Although there are annual fluctuations over the 25-year forecast period, the annual funding gap is forecast to remain relatively stable, when measured in constant 2015 dollars.

**Exhibit 23. Projected annual ODOT funding deficit for non-modernization highway uses,
FYE 2015 to 2040, millions (Constant 2015 \$)**

FYE	Total Hwy Revenue Available for State	Hwy Revenue Reserved for D/S and Modernization	Remaining Hwy Revenue Available for Non-Modernization	Non-Modernization State Needs	Non-Modernization Gap	Percent Funded
2015	\$ 1,012	\$ 108	\$ 904	\$ 1,079	\$ (175)	84 %
2016	\$ 993	\$ 106	\$ 887	\$ 1,075	\$ (188)	82 %
2017	\$ 986	\$ 103	\$ 883	\$ 1,071	\$ (188)	82 %
2018	\$ 978	\$ 101	\$ 877	\$ 1,067	\$ (190)	82 %
2019	\$ 971	\$ 99	\$ 872	\$ 1,064	\$ (192)	82 %
2020	\$ 1,016	\$ 97	\$ 919	\$ 1,060	\$ (141)	87 %
2021	\$ 957	\$ 95	\$ 862	\$ 1,057	\$ (195)	82 %
2022	\$ 947	\$ 93	\$ 854	\$ 1,053	\$ (199)	81 %
2023	\$ 941	\$ 91	\$ 850	\$ 1,050	\$ (200)	81 %
2024	\$ 934	\$ 90	\$ 844	\$ 1,047	\$ (203)	81 %
2025	\$ 928	\$ 88	\$ 840	\$ 1,044	\$ (204)	80 %
2026	\$ 973	\$ 86	\$ 887	\$ 1,041	\$ (154)	85 %
2027	\$ 915	\$ 84	\$ 831	\$ 1,038	\$ (207)	80 %
2028	\$ 909	\$ 74	\$ 835	\$ 1,035	\$ (200)	81 %
2029	\$ 903	\$ 65	\$ 838	\$ 1,032	\$ (194)	81 %
2030	\$ 897	\$ 63	\$ 834	\$ 1,026	\$ (192)	81 %
2031	\$ 864	\$ 57	\$ 807	\$ 959	\$ (193)	81 %
2032	\$ 938	\$ 61	\$ 877	\$ 1,021	\$ (144)	86 %
2033	\$ 880	\$ 60	\$ 820	\$ 1,019	\$ (199)	81 %
2034	\$ 875	\$ 59	\$ 816	\$ 1,016	\$ (200)	80 %
2035	\$ 869	\$ 58	\$ 811	\$ 1,014	\$ (203)	80 %
2036	\$ 864	\$ 57	\$ 807	\$ 959	\$ (152)	84 %
2037	\$ 859	\$ 56	\$ 803	\$ 959	\$ (156)	84 %
2038	\$ 905	\$ 55	\$ 850	\$ 958	\$ (108)	89 %
2039	\$ 849	\$ 54	\$ 795	\$ 958	\$ (163)	83 %
2040	\$ 844	\$ 53	\$ 791	\$ 957	\$ (166)	83 %

Capital Source: ODOT Long-Range Revenue Tables 2013 v3. Summarized by ECONorthwest.

ODOT does not track state expenditures on operations and maintenance at the local level, and therefore we have no forecast for the amount of State expenditures for operations and maintenance of state highways within the BMPO. Based on the Statewide analysis shown in Exhibit 22 and Exhibit 23, it is reasonable to assume that the State will have funding to cover approximately 82% of the need for highway operations and maintenance in the BMPO, and that annual funding for operations and maintenance should remain stable (in constant 2015 dollars) over the forecast period.

Capital projects

Exhibit 24 shows ODOT's projected revenues for modernization under ORS 366.507. In FYE 2015, 31% of State revenue for modernization is dedicated to pay debt service on previous bonds for transportation projects. These debt service payments continue through FYE 2028. In FYE 2015, ODOT forecasts \$56.4 million in revenue for modernization projects net of debt service and federal match (i.e., revenue that ODOT can spend on new capital projects). This level of funding is forecast to fluctuate some over time, but will generally remain at today's funding level in constant 2015 dollars.

Exhibit 24. Projected statewide annual revenue available for transportation modernization projects, ODOT, FYE 2015 to 2040 (millions)

FYE	YOE \$				Funds Net of Debt Service & Federal Match	Constant 2015 \$				Funds Net of Debt Service & Federal Match
	Funds for Hwy Modernization ORS 366.507	Funds Reserved for Debt Service	Funds for Fed Modernization Projects			Funds for Hwy Modernization ORS366.507	Funds Reserved for Debt Service	Funds for Fed Modernizations Projects		
2015	\$ 82.6	\$ 25.2	\$ 1.0		\$ 56.4	\$ 82.6	\$ 25.2	\$ 1.0		\$ 56.4
2016	\$ 83.7	\$ 25.2	\$ 1.0		\$ 57.5	\$ 81.2	\$ 24.4	\$ 1.0		\$ 55.7
2017	\$ 84.8	\$ 25.2	\$ 1.0		\$ 58.5	\$ 79.7	\$ 23.7	\$ 1.0		\$ 55.1
2018	\$ 85.9	\$ 25.2	\$ 1.0		\$ 59.6	\$ 78.3	\$ 23.0	\$ 0.9		\$ 54.4
2019	\$ 87.0	\$ 25.2	\$ 1.1		\$ 60.7	\$ 77.0	\$ 22.3	\$ 0.9		\$ 53.7
2020	\$ 88.1	\$ 25.2	\$ 8.5		\$ 54.4	\$ 75.6	\$ 21.6	\$ 7.3		\$ 46.7
2021	\$ 89.3	\$ 25.2	\$ 1.1		\$ 63.0	\$ 74.3	\$ 21.0	\$ 0.9		\$ 52.4
2022	\$ 90.4	\$ 25.2	\$ 1.1		\$ 64.1	\$ 73.0	\$ 20.4	\$ 0.9		\$ 51.8
2023	\$ 91.6	\$ 25.2	\$ 1.1		\$ 66.3	\$ 71.7	\$ 19.7	\$ 0.9		\$ 51.1
2024	\$ 92.8	\$ 25.2	\$ 1.1		\$ 66.5	\$ 70.5	\$ 19.1	\$ 0.9		\$ 50.5
2025	\$ 94.0	\$ 25.2	\$ 1.1		\$ 67.6	\$ 69.3	\$ 18.6	\$ 0.8		\$ 49.8
2026	\$ 95.2	\$ 25.2	\$ 10.1		\$ 59.9	\$ 68.0	\$ 18.0	\$ 7.2		\$ 42.8
2027	\$ 96.4	\$ 25.2	\$ 1.2		\$ 70.1	\$ 66.9	\$ 17.5	\$ 0.8		\$ 48.6
2028	\$ 97.7	\$ 12.6	\$ 1.2		\$ 83.9	\$ 65.7	\$ 8.5	\$ 0.8		\$ 56.4
2029	\$ 99.0	\$ -	\$ 1.2		\$ 97.8	\$ 64.5	\$ -	\$ 0.8		\$ 63.8
2030	\$ 100.3	\$ -	\$ 1.2		\$ 99.0	\$ 63.4	\$ -	\$ 0.8		\$ 62.6
2031	\$ 101.6	\$ -	\$ 1.2		\$ 100.3	\$ 62.3	\$ -	\$ 0.8		\$ 61.5
2032	\$ 102.9	\$ -	\$ 12.0		\$ 90.9	\$ 61.2	\$ -	\$ 7.1		\$ 54.1
2033	\$ 104.2	\$ -	\$ 1.3		\$ 102.9	\$ 60.2	\$ -	\$ 0.7		\$ 59.4
2034	\$ 105.6	\$ -	\$ 1.3		\$ 104.3	\$ 59.1	\$ -	\$ 0.7		\$ 58.4
2035	\$ 106.9	\$ -	\$ 1.3		\$ 105.6	\$ 58.1	\$ -	\$ 0.7		\$ 57.4
2036	\$ 108.3	\$ -	\$ 1.3		\$ 107.0	\$ 57.1	\$ -	\$ 0.7		\$ 56.4
2037	\$ 109.7	\$ -	\$ 1.4		\$ 108.4	\$ 56.1	\$ -	\$ 0.7		\$ 55.4
2038	\$ 111.2	\$ -	\$ 14.2		\$ 96.9	\$ 55.1	\$ -	\$ 7.1		\$ 48.0
2039	\$ 112.6	\$ -	\$ 1.4		\$ 111.2	\$ 54.1	\$ -	\$ 0.7		\$ 53.5
2040	\$ 114.1	\$ -	\$ 1.4		\$ 112.7	\$ 53.2	\$ -	\$ 0.7		\$ 52.5

Source: ODOT Long-Range Revenue Tables 2013 v3. Summarized by ECONorthwest.

ODOT uses an agreed upon formula to allocate modernization revenues to each of the five ODOT regions across the State. The formula is based on population, vehicle miles traveled (VMT), ton miles traveled, vehicle registrations, and revenue estimates from the 1999-2001 biennium. The BMPO is located in Region 4. Exhibit 25 shows the ODOT calculation of Region 4's share of total ODOT revenue for modernization projects, resulting in Region 4 receiving 9.9% of the State's revenues.

Exhibit 25. ODOT Region 4 share of State revenue for transportation modernization projects

County	Population (2011)	VMT (2011)	Ton Miles Traveled(2011)	Vehicle Registration (2011)	Projected Revenue (1999-2011)	Modernization Needs (1999)
Crook	20,855	90,031,740	302,815,362	31,946	15,016,000	
Deschutes	158,875	627,627,967	3,683,820,392	198,008	81,945,000	
Gilliam	1,880	146,396,755	1,795,009,114	3,678	21,211,000	
Jefferson	21,845	185,522,456	1,152,991,696	26,304	24,980,000	
Klamath	66,580	423,596,334	3,144,659,132	84,857	71,971,000	
Lake	7,885	67,348,669	387,085,234	13,113	14,863,000	
Sherman	1,765	111,043,950	1,227,350,708	3,725	16,956,000	
Wasco	25,300	325,122,035	2,667,279,490	31,775	44,629,000	
Wheeler	1,435	20,055,692	136,589,258	2,431	5,921,000	
Region 4 Total	306,420	1,996,745,598	14,497,870,386	395,837	297,492,000	
Statewide Total	3,857,625	19,426,126,596	109,029,809,309	4,062,873	2,698,465,000	
Region 4 % of State	7.94%	10.28%	13.30%	9.74%	11.02%	9.90%

Source: ODOT Long-Range Revenue Tables 2013 v3. Summarized by ECONorthwest.

There is no agreed upon formula for how Region 4 allocates ODOT revenue for modernization projects in different municipalities within the Region. Instead, it is a political process, where local representatives meet with ODOT Region 4 staff to discuss modernization needs and agree on a fair share of revenue. For the purposes of this analysis, we met with staff of ODOT Region 4 and the BMPO to discuss appropriate assumptions for future years. We decided that the same formula (population, VMT, etc.) could be used to estimate the likely allocation of funds between Region 4 counties. We assumed that 50% of funding for projects in Deschutes County would likely be allocated to projects in the BMPO, as the BMPO area has a little more than 50% of the total County population. Based on these assumptions, we calculated the BMPO would receive a 1.93% share of future State revenue for modernization. Exhibit 26 shows these revenue forecasts, which result in roughly \$1 million per year in constant 2015 dollars.

Exhibit 26. Projected annual allocation of revenue to the BMPO for transportation modernization projects, FYE 2015 to 2040

FYE	YOE \$				Constant 2015 \$			
	Funds Net of Debt Service & Federal Match	BMPO Share		State Modernization Funds for BMPO	Funds for Fed Modernization Projects	BMPO Share		State Modernization Funds for BMPO
2015	\$ 56,402,673	1.93	%	\$ 1,088,829	\$ 56,402,700	1.93	%	\$ 1,088,829
2016	\$ 57,462,510	1.93	%	\$ 1,109,289	\$ 55,734,700	1.93	%	\$ 1,075,934
2017	\$ 58,536,112	1.93	%	\$ 1,130,014	\$ 55,066,900	1.93	%	\$ 1,063,042
2018	\$ 59,623,656	1.93	%	\$ 1,151,009	\$ 54,401,100	1.93	%	\$ 1,050,089
2019	\$ 60,725,323	1.93	%	\$ 1,172,276	\$ 53,739,200	1.93	%	\$ 1,037,412
2020	\$ 54,419,235	1.93	%	\$ 1,050,540	\$ 46,711,800	1.93	%	\$ 901,751
2021	\$ 62,971,766	1.93	%	\$ 1,215,642	\$ 52,428,400	1.93	%	\$ 1,012,107
2022	\$ 64,116,915	1.93	%	\$ 1,237,749	\$ 51,778,200	1.93	%	\$ 999,556
2023	\$ 65,276,936	1.93	%	\$ 1,260,143	\$ 51,129,400	1.93	%	\$ 987,031
2024	\$ 66,452,021	1.93	%	\$ 1,282,827	\$ 50,483,900	1.93	%	\$ 974,570
2025	\$ 67,642,367	1.93	%	\$ 1,305,806	\$ 49,843,300	1.93	%	\$ 962,203
2026	\$ 59,934,089	1.93	%	\$ 1,157,001	\$ 42,834,500	1.93	%	\$ 826,901
2027	\$ 70,069,636	1.93	%	\$ 1,352,664	\$ 48,571,800	1.93	%	\$ 937,657
2028	\$ 83,906,963	1.93	%	\$ 1,619,787	\$ 56,415,600	1.93	%	\$ 1,089,079
2029	\$ 97,760,358	1.93	%	\$ 1,887,221	\$ 63,754,000	1.93	%	\$ 1,230,743
2030	\$ 99,030,031	1.93	%	\$ 1,911,731	\$ 62,641,600	1.93	%	\$ 1,209,269
2031	\$ 100,316,193	1.93	%	\$ 1,936,560	\$ 61,547,500	1.93	%	\$ 1,188,148
2032	\$ 90,913,023	1.93	%	\$ 1,755,036	\$ 54,102,000	1.93	%	\$ 1,044,415
2033	\$ 102,938,842	1.93	%	\$ 1,987,189	\$ 59,416,400	1.93	%	\$ 1,147,008
2034	\$ 104,275,766	1.93	%	\$ 2,012,998	\$ 58,378,600	1.93	%	\$ 1,126,973
2035	\$ 105,630,053	1.93	%	\$ 2,039,142	\$ 57,357,800	1.93	%	\$ 1,107,267
2036	\$ 107,001,926	1.93	%	\$ 2,065,625	\$ 56,355,400	1.93	%	\$ 1,087,916
2037	\$ 108,391,616	1.93	%	\$ 2,092,453	\$ 55,369,600	1.93	%	\$ 1,068,886
2038	\$ 96,941,139	1.93	%	\$ 1,871,406	\$ 48,031,100	1.93	%	\$ 927,219
2039	\$ 111,225,371	1.93	%	\$ 2,147,157	\$ 53,450,600	1.93	%	\$ 1,031,840
2040	\$ 112,669,909	1.93	%	\$ 2,175,043	\$ 52,517,000	1.93	%	\$ 1,013,818

Source: ODOT Long-Range Revenue Tables 2013 v3. Summarized by ECONorthwest.

These long-term projections of State funds for modernization in the BMPO are consistent with short-term planned projects in the Statewide Transportation Improvement Program (STIP). Exhibit 27 shows all projects in the current STIP (FYE 2015 to 2018) that are located in the BMPO. These projects combine for a total cost of \$18.6 million, with \$8.7 million in funding coming from the State, and the remaining funding from “other” local sources. The revenue amounts in Exhibit 27, however, include funding from previous years for projects that spanned multiple STIP programming cycles. Accounting for those prior year revenues, the current STIP shows roughly \$4.6 million in ODOT spending on capital projects in the BMPO over the next four years, or \$1.1 million per year.

Exhibit 27. Projected State funding for STIP projects in BMPO, FYE 2015 to 2018

Route	Description	Funding by source				Total
		STP-FLX	Interstate Maintenance	State	Other	
US-97	Corridor planning & development		\$ 4,780,685		\$ 8,703,315	\$ 13,484,000
South 3 rd Street	Bike and ped improvements from Franklin To Murphy Road	\$ 2,510,645			\$ 833,355	\$ 3,344,000
US-20	Traffic signal replacement	\$ 744,759		\$ 30,000	\$ 285,241	\$ 1,060,000
OB Riley Road	Communication infrastructure for signals to ODOT facility	\$ 108,574			\$ 27,426	\$ 136,000
Empire Avenue	Communication infrastructure for signals to ODOT facility	\$ 117,547			\$ 57,453	\$ 175,000
US-97	Install cameras	\$ 354,434		\$ 5,000	\$ 40,566	\$ 400,000
Total		\$ 3,835,959	\$ 4,780,685	\$ 35,000	\$ 9,947,356	\$ 18,599,000

Source: ODOT Statewide Transportation Improvement Plan 2015-2018;

http://www.oregon.gov/ODOT/TD/STIP/Pages/STIPDocs.aspx#2015_-_2018_STIP. Summarized by ECONorthwest.

In addition to the projected State revenue sources shown in Exhibit 26 and Exhibit 27, there are a few short-term funding commitments from the State for capital projects. The State has pledged \$1 million in funding from the Highway Safety Improvement Program (HSIP). The State has also committed \$5 million in funding for US-97/Coolley Road intersection improvements through agreements with the City of Bend. Exhibit 28 shows the forecast of total ODOT spending on transportation capital projects in the BMPO from FYE 2015 to 2040.

Exhibit 28. Projected State funding for capital projects in BMPO, FYE 2015 to 2040

FYE	Annual Funding	
	YOE \$	Constant 2015\$
2015	\$ 1,088,829	\$ 1,088,829
2016	\$ 7,109,289	\$ 6,895,527
2017	\$ 1,130,014	\$ 1,063,042
2018	\$ 1,151,009	\$ 1,050,189
2019	\$ 1,172,276	\$ 1,037,412
2020	\$ 1,050,540	\$ 901,751
2021	\$ 1,215,642	\$ 1,012,107
2022	\$ 1,237,749	\$ 999,556
2023	\$ 1,260,143	\$ 987,031
2024	\$ 1,282,827	\$ 974,570
2025	\$ 1,305,806	\$ 962,203
2026	\$ 1,157,001	\$ 826,901
2027	\$ 1,352,664	\$ 937,657
2028	\$ 1,619,787	\$ 1,089,079
2029	\$ 1,887,221	\$ 1,230,743
2030	\$ 1,911,731	\$ 1,209,269
2031	\$ 1,936,560	\$ 1,188,148
2032	\$ 1,755,036	\$ 1,044,415
2033	\$ 1,987,189	\$ 1,147,008
2034	\$ 2,012,998	\$ 1,126,973
2035	\$ 2,039,142	\$ 1,107,267
2036	\$ 2,065,625	\$ 1,087,916
2037	\$ 2,092,453	\$ 1,068,886
2038	\$ 1,871,406	\$ 927,219
2039	\$ 2,147,157	\$ 1,031,840
2040	\$ 2,175,043	\$ 1,013,818
Total	\$ 47,015,137	\$ 33,009,356
Average	\$ 1,808,275	\$ 1,269,591

Calculated by ECONorthwest based on ODOT Long-Range Revenue Tables 2013 v3, adjusted to reflect additional State revenues in FYE 2016.

Deschutes County

Deschutes County is responsible for building and maintaining an extensive roadway network. The vast majority of the County road network is in unincorporated areas of the County. Only a small portion of the BMPO is in unincorporated Deschutes County, with the bulk of the BMPO located within the city limits of Bend. Thus, only a small fraction of the County's transportation expenditures occur within the BMPO, and those expenditures are focused on the unincorporated areas of the BMPO, which are generally located east and south of the City of the Bend.

The Deschutes County budget does not show a distinction between expenditures in the BMPO and expenditures elsewhere in the County. Therefore, our analysis needed to estimate the portion of the County's transportation expenditures occurring in the BMPO. For operations and maintenance, we based this estimate off of the number of lane miles of County-owned roads in the BMPO, shown in Exhibit 29. In total, the County owns 58.1 lane miles within the BMPO.

Exhibit 29. Summary of Deschutes County-owned roadway lane miles, 2014

Road Type	Lane Miles
Arterials	10.4
Collectors	10.0
Local Roads	36.8
Forest Highway	1.0
Total	58.1

Source: Deschutes County, 2014

Operations, maintenance and administration

Exhibit 30 shows historical budget information for Deschutes County on revenues for transportation operations, maintenance and administration. Annual average revenues (excluding beginning working capital) were \$15.8 million over this six-year period, with most revenue sources experiencing little to no growth until the FYE 2015 proposed budget, which shows a significant increase in federal funding and interfund charges and transfers.

Exhibit 30. Historical transportation revenues for operations, maintenance and administration, Deschutes County, FYE 2010 to 2015 (YOE dollars)

	FYE 2010 Actual	FYE 2011 Actual	FYE 2012 Actual	FYE 2013 Actual	FYE 2014 Budgeted	FYE 2015 Proposed
Resources						
Beginning working capital	\$4,891,649	\$3,419,603	\$3,417,158	\$4,723,852	\$6,014,368	\$8,954,332
Federal payments	\$2,633,352	\$2,390,545	\$2,086,374	\$1,413,204	\$496,270	\$2,300,950
State payments	\$7,782,520	\$9,043,510	\$11,760,863	\$11,040,333	\$11,327,952	\$11,822,629
Local payments	\$654,792	\$809,788	\$354,425	\$372,871	\$700,000	\$804,200
Interfund charges/transfers	\$1,951,629	\$1,603,373	\$2,331,329	\$1,867,886	\$2,120,148	\$3,821,856
Sale of assets, land, or equipment	\$276,838	\$216,215	\$309,049	\$287,313	\$270,000	\$271,000
Other	\$674,018	\$644,582	\$67,760	\$64,743	\$40,200	\$57,500
Total Revenues	\$18,864,798	\$18,127,616	\$20,326,958	\$19,770,202	\$20,958,938	\$28,032,467

Sources:

Deschutes County, Oregon Proposed Budget Fiscal Year 2015, Pages 152-156
Deschutes County, Oregon Adopted Budget Fiscal Year 2013, Pages 144-151

To estimate the annual cost for operations, maintenance and administration of County roads within the BMPO, the County estimated the average annual cost per lane mile to be \$10,000 to \$15,000. Using the mid-range estimate of \$12,500 per lane mile, and the total 58.1 lane miles within the BMPO, we calculate the annual cost to be about \$725,000 per year, or roughly 5% of the County's recent historical expenditures on operations, maintenance, and administration. We assume that annual funding for County operations, maintenance, and administration will remain flat in constant 2015 dollars, increasing over time at a rate equal to inflation.

Capital projects

Exhibit 31 shows historical annual revenues for Deschutes County transportation capital projects. Excluding beginning working capital, annual revenues have averaged \$1.1 million over the six-year period. Interfund transfers are the largest revenue source, accounting for 60% of total revenue over this period of time.

Exhibit 31. Historical transportation revenues for capital projects, Deschutes County, FYE 2010 to 2015 (YOE dollars)

	FYE 2010 Actual	FYE 2011 Actual	FYE 2012 Actual	FYE 2013 Actual	FYE 2014 Budgeted	FYE 2015 Proposed
Resources						
Beginning working capital	\$1,614,941	\$1,781,748	\$2,176,054	\$2,197,577	\$2,525,909	\$3,198,221
Licenses & Permits	\$199,977	\$291,982	\$390,349	\$523,614	\$325,000	\$425,000
Interfund Transfers	\$408,346	\$639,073	\$816,000	\$451,400	\$607,380	\$835,060
Other	\$253,244	\$40,047	\$76,081	\$33,516	\$12,850	\$8,100
Total	\$2,476,508	\$2,752,580	\$3,458,484	\$3,206,107	\$3,471,139	\$4,466,381

Sources:

Deschutes County, Oregon Proposed Budget Fiscal Year 2015, Pages 152-156
Deschutes County, Oregon Adopted Budget Fiscal Year 2013, Pages 144-151

The County CIP shows planned funding for capital projects for the next five years. None of the transportation projects in the County's CIP are located within the BMPO. Although it is possible the County may have some future capital expenditures in the area, any such projects would be speculative at this time, and are unlikely to result in a significant amount of funding. Therefore, our analysis assumes no future funding from Deschutes County for capital projects in the BMPO.

Cascades East Transit (CET)

Cascades East Transit (CET) – CET is the public transportation service administered by the Central Oregon Intergovernmental Council (COIC). CET provides transportation services for people across the three Central Oregon counties of Deschutes, Jefferson, and Crook.

2007 was the first year in which fixed-route transit service operated in the City of Bend. This initial transit service was operated by the City of Bend, but in 2010, responsibility for public transit was turned over to CET. In addition to serving the City of Bend, CET provides regional transit services, connecting Bend with neighboring cities like Madras, Sisters, Redmond, Prineville, and LaPine, as well as destinations like Mt. Bachelor Ski Resort. In addition, Dial-a-Ride (curb-to-burb) service is available to persons with disabilities and low-income seniors in Bend city limits.

CET's budget is divided into two geographies: The "urban" service area includes transit service within the BMPO, and the "rural" service area includes transit service elsewhere

in CET's tri-county service area. Throughout this report, we refer to the urban service portion of CET's budget, unless otherwise stated.

The 2013 Bend Transit Plan recommends strategies to coordinate future transit investments with transit-supportive land uses. The Plan identified four sets of service options, outlining different improvements that could be made to CET service to achieve different levels of transit ridership. Input from staff at the BMPO and CET indicate that the most likely scenario that will be implemented going forward is the "mid-term" scenario, which calls for increasing total annual fixed-route vehicle revenue hours from 20,700 in 2011 to 32,900, and increasing the number of buses operating during peak hours from seven to nine.

Exhibit 32 shows the historical annual revenues and expenditures for CET urban service area, including actual revenues for FYE 2012 to 2013. Note that we were unable to obtain budget information for more recent years. Also note that CET historical budget documents do not separate operating, maintenance and administration from capital expenditures, as reflected in Exhibit 32.

Exhibit 32. Historical annual transit revenues and expenditures, Cascade East Transit - urban service area, FYE 2012 to 2013 (YOE \$)

		FYE 2012	FYE 2013
Resources			
Federal Funds	\$	705,913	707,376
ODOT Funds	\$	379,817	257,404
City of Bend	\$	1,205,218	962,743
Deschutes County	\$	114,947	139,582
Bus Fares	\$	293,938	275,988
Advertising	\$	20,000	20,000
Other	\$	34,334	62,995
Total Revenue	\$	2,754,167	2,426,087
Expenditures			
Administration	\$	60,306	84,246
Personal Service	\$	259,442	327,270
Materials and Services	\$	2,171,457	1,999,518
Capital Expenditures	\$	265,244	-
Total Expenditures	\$	2,756,450	2,411,035
Annual Surplus (Deficit)	\$	(2,282)	15,053

Source: COIC Income Statements, 485-Bend Area Transit Admin, and 486-Bend Area Transit Program, for 12 Periods Ended 6/20/12 and 6/30/13.

Revenue sources for CET

Funding for operations, maintenance, and administration of CET comes from federal, state, and local sources, as well as revenue derived from CET operations (i.e., fares, public-private partnerships, and other sources). Federal sources include: FTA Section 5307 – Urbanized Area Formula Program, and FTA Section 5310 – Enhanced Mobility for Seniors and Individuals with Disabilities Program. State funding sources include the Special Transportation Fund, and Oregon Lottery. The largest single source of revenue

for CET operations is an allocation from the City of Bend, agreed upon in a multi-year agreement with COIC that runs through September 1, 2015, with the potential to be extended for additional years.

Exhibit 33 shows projected annual revenues for transit operations, maintenance and administration, and capital projects for CET. Projections for FYE 2015 to FYE 2022 were provided by the BMPO in the Bend Transit Plan. Projections for future years were calculated by ECONorthwest.

Total revenue is projected to grow from just over three million to more than seven million in 2040 (Exhibit 33). Federal funds are the largest source of revenue, with funds from the City of Bend being the second largest source of revenue.

Exhibit 33. Projected annual revenues for transit operations, maintenance and administration, and capital projects, Cascades East Transit – urban service area, FYE 2015 to 2040 (YOE \$)

FYE	Fare Revenue	Intergovernmental Revenue			Other Revenue	Total Revenue
		Federal	State	City		
2015	\$ 453,389	\$ 1,454,069	\$ 126,368	\$ 1,079,675	\$ 38,463	\$ 3,151,964
2016	\$ 512,937	\$ 1,497,690	\$ 130,159	\$ 1,106,667	\$ 42,076	\$ 3,289,529
2017	\$ 557,539	\$ 1,542,621	\$ 134,063	\$ 1,134,333	\$ 43,155	\$ 3,411,711
2018	\$ 694,809	\$ 1,588,900	\$ 138,085	\$ 1,162,692	\$ 55,299	\$ 3,639,785
2019	\$ 755,956	\$ 1,636,566	\$ 142,228	\$ 1,191,759	\$ 56,710	\$ 3,783,219
2020	\$ 822,361	\$ 1,685,664	\$ 146,495	\$ 1,221,553	\$ 58,156	\$ 3,934,229
2021	\$ 892,099	\$ 1,736,234	\$ 150,890	\$ 1,252,092	\$ 59,640	\$ 4,090,955
2022	\$ 967,591	\$ 1,788,321	\$ 155,416	\$ 1,283,394	\$ 61,162	\$ 4,255,884
2023	\$ 997,586	\$ 1,843,759	\$ 160,234	\$ 1,323,179	\$ 63,058	\$ 4,387,816
2024	\$ 1,028,511	\$ 1,900,915	\$ 165,201	\$ 1,364,198	\$ 65,013	\$ 4,523,839
2025	\$ 1,060,395	\$ 1,959,844	\$ 170,322	\$ 1,406,488	\$ 67,028	\$ 4,664,078
2026	\$ 1,093,268	\$ 2,020,599	\$ 175,602	\$ 1,450,089	\$ 69,106	\$ 4,808,664
2027	\$ 1,127,159	\$ 2,083,238	\$ 181,046	\$ 1,495,042	\$ 71,248	\$ 4,957,733
2028	\$ 1,162,101	\$ 2,147,818	\$ 186,658	\$ 1,541,388	\$ 73,457	\$ 5,111,422
2029	\$ 1,198,126	\$ 2,214,400	\$ 192,445	\$ 1,589,171	\$ 75,734	\$ 5,269,877
2030	\$ 1,235,268	\$ 2,283,047	\$ 198,411	\$ 1,638,435	\$ 78,082	\$ 5,433,243
2031	\$ 1,273,561	\$ 2,353,821	\$ 204,561	\$ 1,689,227	\$ 80,503	\$ 5,601,673
2032	\$ 1,313,042	\$ 2,426,790	\$ 210,903	\$ 1,741,593	\$ 82,998	\$ 5,775,325
2033	\$ 1,353,746	\$ 2,502,020	\$ 217,441	\$ 1,795,582	\$ 85,571	\$ 5,954,360
2034	\$ 1,395,712	\$ 2,579,583	\$ 224,181	\$ 1,851,245	\$ 88,224	\$ 6,138,945
2035	\$ 1,438,979	\$ 2,659,550	\$ 231,131	\$ 1,908,634	\$ 90,959	\$ 6,329,253
2036	\$ 1,483,587	\$ 2,741,996	\$ 238,296	\$ 1,967,802	\$ 93,778	\$ 6,525,459
2037	\$ 1,529,579	\$ 2,826,998	\$ 245,683	\$ 2,028,803	\$ 96,686	\$ 6,727,749
2038	\$ 1,576,996	\$ 2,914,635	\$ 253,300	\$ 2,091,696	\$ 99,683	\$ 6,936,309
2039	\$ 1,352,882	\$ 3,004,988	\$ 261,152	\$ 2,156,539	\$ 102,773	\$ 7,151,334
2040	\$ 1,676,285	\$ 3,098,143	\$ 269,248	\$ 2,223,392	\$ 105,959	\$ 7,373,026

Source: Calculated by ECONorthwest, based on 2013 City of Bend Transportation System Plan

Exhibit 34 shows the same financial projections as Exhibit 33, but adjusted for inflation and presented in constant 2015 dollars.

Exhibit 34. Projected annual revenues for transit operations, maintenance and administration, and capital projects, Cascades East Transit – urban service area, FYE 2015 to 2040 (Constant 2015 \$)

FYE	Fare Revenue	Intergovernmental Revenue			Other Revenue	Total Revenue
		Federal	State	City		
2015	\$ 453,389	\$ 1,454,389	\$ 126,368	\$ 1,079,675	\$ 38,463	\$ 3,151,964
2016	\$ 497,514	\$ 1,452,658	\$ 126,245	\$ 1,073,392	\$ 40,811	\$ 3,190,620
2017	\$ 524,496	\$ 1,451,196	\$ 126,118	\$ 40,597	\$ 40,597	\$ 3,209,512
2018	\$ 633,950	\$ 1,449,726	\$ 125,990	\$ 1,060,850	\$ 50,455	\$ 3,320,972
2019	\$ 668,988	\$ 1,448,288	\$ 125,865	\$ 1,054,654	\$ 50,186	\$ 3,347,981
2020	\$ 705,889	\$ 1,446,922	\$ 125,747	\$ 1,048,543	\$ 49,919	\$ 3,377,021
2021	\$ 742,735	\$ 1,445,537	\$ 125,627	\$ 1,042,454	\$ 49,654	\$ 3,406,007
2022	\$ 781,387	\$ 1,444,174	\$ 125,508	\$ 1,036,416	\$ 49,392	\$ 3,436,876
2023	\$ 781,379	\$ 1,444,160	\$ 125,506	\$ 1,036,406	\$ 49,391	\$ 3,436,842
2024	\$ 781,366	\$ 1,444,135	\$ 125,504	\$ 1,036,388	\$ 49,391	\$ 3,436,784
2025	\$ 781,369	\$ 1,444,141	\$ 125,505	\$ 1,036,392	\$ 49,391	\$ 3,436,797
2026	\$ 781,352	\$ 1,444,110	\$ 125,502	\$ 1,036,370	\$ 49,390	\$ 3,436,724
2027	\$ 781,338	\$ 1,444,085	\$ 125,500	\$ 1,036,352	\$ 49,389	\$ 3,436,665
2028	\$ 781,349	\$ 1,444,105	\$ 125,502	\$ 1,036,367	\$ 49,390	\$ 3,436,712
2029	\$ 781,353	\$ 1,444,111	\$ 125,502	\$ 1,036,371	\$ 49,390	\$ 3,436,727
2030	\$ 781,370	\$ 1,444,144	\$ 125,505	\$ 1,036,394	\$ 49,391	\$ 3,436,804
2031	\$ 781,374	\$ 1,444,151	\$ 125,505	\$ 1,036,399	\$ 49,391	\$ 3,436,820
2032	\$ 781,386	\$ 1,444,174	\$ 125,508	\$ 1,036,416	\$ 49,392	\$ 3,436,875
2033	\$ 781,383	\$ 1,444,167	\$ 125,507	\$ 1,036,411	\$ 49,392	\$ 3,436,860
2034	\$ 781,386	\$ 1,444,174	\$ 125,507	\$ 1,036,416	\$ 49,392	\$ 3,436,875
2035	\$ 781,374	\$ 1,444,152	\$ 125,506	\$ 1,036,400	\$ 49,391	\$ 3,436,823
2036	\$ 781,370	\$ 1,444,144	\$ 125,505	\$ 1,036,394	\$ 49,391	\$ 3,436,804
2037	\$ 781,354	\$ 1,444,114	\$ 125,502	\$ 1,036,373	\$ 49,390	\$ 3,436,733
2038	\$ 781,348	\$ 1,444,104	\$ 125,501	\$ 1,036,365	\$ 49,389	\$ 3,436,709
2039	\$ 781,336	\$ 1,444,081	\$ 125,499	\$ 1,036,349	\$ 49,389	\$ 3,436,655
2040	\$ 781,339	\$ 1,444,086	\$ 125,499	\$ 1,036,353	\$ 49,389	\$ 3,436,667

Source: Calculated by ECONorthwest, based on 2013 City of Bend Transportation System Plan

The proposed transit-service improvements in the mid-term scenario identified in the Bend Transit Plan are projected to increase annual operating expenses for fixed-route operating costs from approximately \$1.5 million per year to \$2.4 million per year (constant dollars, unadjusted for inflation), an increase of \$880,000. Additionally, this increased level of service is estimated to increase the cost of Dial-a-Ride service by 10%, from \$1.0 million to \$1.1 million per year.

Exhibit 35 shows projected annual expenditures for transit operations, maintenance and administration, and capital projects for CET, as well as the projected revenue streams to fund these operations and capital projects. Projections for FYE 2015 to FYE 2022 were provided by the BMPO in the Bend Transit Plan. Projections for future years were calculated by ECONorthwest, assuming FYE 2022 levels of expenditures are maintained through FYE 2040, increasing annually at a pace equal to the rate of inflation.

Total expenditures for CET are projected to grow from just under three million dollars in 2015 to more than eight million dollars in 2040. Beginning in 2016, CET is expected to

experience an operating deficit that will be sustained for the remainder of the forecast period. This annual deficit is projected to grow to more than \$850,000 in 2040 (YOE \$).

Exhibit 35. Projected total annual revenues and expenditures for transit operations, maintenance and administration, and capital projects, Cascades East Transit – urban service area, FYE 2015 to 2040 (YOE \$)

FYE	Total Revenue	Expenditures			Funding Gap
		Operations	Capital	Total Expenditures	
2015	\$ 3,151,964	\$ 2,519,615	\$ 344,412	\$ 2,864,027	\$ 287,937
2016	\$ 3,289,529	\$ 2,851,570	\$ 495,658	\$ 3,347,228	\$ (57,699)
2017	\$ 3,411,711	\$ 2,935,700	\$ 623,673	\$ 3,559,373	\$ (147,662)
2018	\$ 3,639,785	\$ 3,768,913	\$ 773,848	\$ 4,542,761	\$ (902,976)
2019	\$ 3,783,219	\$ 3,884,252	\$ 461,023	\$ 4,345,275	\$ (562,056)
2020	\$ 3,934,229	\$ 4,003,297	\$ 468,266	\$ 4,471,563	\$ (537,334)
2021	\$ 4,090,955	\$ 4,126,170	\$ 475,790	\$ 4,601,960	\$ (511,005)
2022	\$ 4,255,884	\$ 4,252,998	\$ 496,784	\$ 4,749,782	\$ (493,898)
2023	\$ 4,387,816	\$ 4,384,841	\$ 512,184	\$ 4,897,025	\$ (509,209)
2024	\$ 4,523,839	\$ 4,520,771	\$ 528,062	\$ 5,048,833	\$ (524,994)
2025	\$ 4,664,078	\$ 4,660,915	\$ 544,432	\$ 5,205,347	\$ (541,269)
2026	\$ 4,808,664	\$ 4,805,403	\$ 561,309	\$ 5,366,713	\$ (558,048)
2027	\$ 4,957,733	\$ 4,954,371	\$ 578,710	\$ 5,533,081	\$ (575,348)
2028	\$ 5,111,422	\$ 5,107,956	\$ 596,650	\$ 5,704,606	\$ (593,184)
2029	\$ 5,269,877	\$ 5,266,303	\$ 615,146	\$ 5,881,449	\$ (611,572)
2030	\$ 5,433,243	\$ 5,429,558	\$ 634,216	\$ 6,063,774	\$ (630,531)
2031	\$ 5,601,673	\$ 5,597,875	\$ 653,876	\$ 6,251,751	\$ (650,078)
2032	\$ 5,775,325	\$ 5,771,409	\$ 674,146	\$ 6,445,555	\$ (670,230)
2033	\$ 5,954,360	\$ 5,950,322	\$ 695,045	\$ 6,645,367	\$ (691,007)
2034	\$ 6,138,945	\$ 6,134,782	\$ 716,591	\$ 6,851,374	\$ (712,428)
2035	\$ 6,329,253	\$ 6,324,961	\$ 738,806	\$ 7,063,766	\$ (734,514)
2036	\$ 6,525,459	\$ 6,521,034	\$ 761,709	\$ 7,282,743	\$ (757,284)
2037	\$ 6,727,749	\$ 6,723,186	\$ 785,322	\$ 7,508,508	\$ (780,759)
2038	\$ 6,936,309	\$ 6,931,605	\$ 809,667	\$ 7,741,272	\$ (804,963)
2039	\$ 7,151,334	\$ 7,146,485	\$ 834,766	\$ 7,981,251	\$ (829,917)
2040	\$ 7,373,026	\$ 7,368,026	\$ 860,644	\$ 8,228,670	\$ (855,644)

Source: Calculated by ECONorthwest, based on 2013 City of Bend Transportation System Plan

Exhibit 36 shows the same financial projections as Exhibit 35, but adjusted for inflation and presented in constant 2015 dollars. Note that the annual funding deficit is expected to stabilize at approximately \$400,000 per year beginning in FYE 2022.

**Exhibit 36. Projected annual revenues and expenditures for transit operations, maintenance and administration, and capital projects, Cascades East Transit – urban service area, FYE 2015 to 2040
(Constant 2015 \$)**

FYE	Total Revenue	Expenditures			Funding Gap
		Operations	Capital	Total Expenditures	
2015	\$ 3,151,964	\$ 2,519,615	\$ 344,412	\$ 2,864,027	\$ 287,937
2016	\$ 3,190,620	\$ 2,765,829	\$ 480,755	\$ 3,246,584	\$ (55,964)
2017	\$ 3,209,512	\$ 2,761,712	\$ 586,710	\$ 3,348,422	\$ (138,910)
2018	\$ 3,320,972	\$ 3,438,789	\$ 706,066	\$ 4,144,855	\$ (823,883)
2019	\$ 3,347,981	\$ 3,437,391	\$ 407,985	\$ 3,845,376	\$ (497,395)
2020	\$ 3,377,021	\$ 3,436,306	\$ 401,945	\$ 3,838,252	\$ (461,231)
2021	\$ 3,406,007	\$ 3,435,326	\$ 396,129	\$ 3,831,455	\$ (425,448)
2022	\$ 3,436,876	\$ 3,434,546	\$ 401,182	\$ 3,835,728	\$ (398,852)
2023	\$ 3,436,842	\$ 3,434,512	\$ 401,178	\$ 3,835,690	\$ (398,848)
2024	\$ 3,436,784	\$ 3,434,453	\$ 401,171	\$ 3,835,561	\$ (398,841)
2025	\$ 3,436,797	\$ 3,434,467	\$ 401,173	\$ 3,835,640	\$ (398,843)
2026	\$ 3,436,724	\$ 3,434,393	\$ 401,176	\$ 3,835,558	\$ (398,834)
2027	\$ 3,436,665	\$ 3,434,334	\$ 401,158	\$ 3,835,492	\$ (398,827)
2028	\$ 3,436,860	\$ 3,434,382	\$ 401,163	\$ 3,835,545	\$ (398,833)
2029	\$ 3,436,727	\$ 3,434,396	\$ 401,165	\$ 3,835,561	\$ (398,834)
2030	\$ 3,436,804	\$ 3,434,473	\$ 401,174	\$ 3,835,647	\$ (398,843)
2031	\$ 3,436,820	\$ 3,434,490	\$ 401,176	\$ 3,835,665	\$ (398,845)
2032	\$ 3,436,875	\$ 3,434,545	\$ 401,182	\$ 3,835,727	\$ (398,852)
2033	\$ 3,436,860	\$ 3,434,530	\$ 401,180	\$ 3,835,710	\$ (398,850)
2034	\$ 3,436,875	\$ 3,434,544	\$ 401,182	\$ 3,835,726	\$ (398,851)
2035	\$ 3,436,823	\$ 3,434,492	\$ 401,176	\$ 3,835,668	\$ (398,845)
2036	\$ 3,436,804	\$ 3,434,473	\$ 401,174	\$ 3,835,647	\$ (398,843)
2037	\$ 3,436,733	\$ 3,434,406	\$ 401,166	\$ 3,835,480	\$ (398,835)
2038	\$ 3,436,709	\$ 3,434,378	\$ 401,163	\$ 3,835,541	\$ (398,832)
2039	\$ 3,436,655	\$ 3,434,324	\$ 401,156	\$ 3,835,480	\$ (398,825)
2040	\$ 3,436,997	\$ 3,434,337	\$ 401,158	\$ 3,835,495	\$ (398,828)

Source: Calculated by ECONorthwest, based on 2013 City of Bend Transportation System Plan

The projections of revenue and expenditures for CET reflect the relatively short operating history for this public agency, as well as the uncertainty regarding future level of service and future funding sources. CET only began providing public transit service for the BMPO in 2010. Development in the CET service area has been rapid in recent years, making demand for transit service difficult to predict. Future projections for population growth indicate that demand may increase significantly over time, requiring significant changes for the level of service provided by CET.

Funding for CET has always relied on local contributions from cities and counties to provide the local match for State and Federal grants. But these local contributions are impermanent and unpredictable, creating uncertainty regarding future funding levels. For those reasons, COIC and CET have been exploring potential long-term, stable, local funding sources.

In January 2014, a CET Local Dedicated Public Funding Subcommittee, appointed by the COIC Board, made recommendations on local public funding options for CET. These recommendations included a two-phased approach, where CET would continue to rely on agreements with cities and counties to provide funding for a base level of

service in the short-term (0-3 years). In phase 2 (3-5 years), CET should develop a dedicated, local, publicly-funded tool to achieve sustainable and convenient service levels across the region. The preferred funding tool would be a region-wide property tax, but that other tools may ultimately prove more feasible or desirable. This proposed, new, dedicated funding source would either replace existing contributions from local jurisdictions, or would enhance the level of service in jurisdictions that choose to continue providing additional funding.

Ultimately, the long-term projections of revenues and expenditures for CET will depend on the level of service that CET chooses to provide, and the amount of permanent local funding that CET is able to obtain.

Conclusions

Unfunded maintenance

It is typical for all types of infrastructure and all levels of government to have insufficient funding to address 100% of their maintenance needs. This is certainly the case in the BMPO as well. As shown earlier in Exhibit 22, the State of Oregon only has sufficient revenues to address 84% of their estimated needs for maintenance and preservation.

The City and County do not quantify their long-term maintenance needs in the same way as the State, but conversations with staff at both jurisdictions indicates that there is a long-term challenge in securing sufficient revenues to fully fund maintenance of the transportation system. As an example, the 2013 City of Bend Pavement Management Program Budget Options Report evaluated the City's street network as being in "Fair" condition. The report concluded that maintaining the City's current funding level for pavement management (\$2.2 million per year) would result in further deterioration of the street network, and that short-term, five-year funding levels would need to increase to \$3.7 million per year to maintain the current level of quality, and would need to increase to \$16 million per year to achieve an "Optimal" condition.

Currently, the City has not identified additional funding sources that could be used for increased funding for maintenance of the existing transportation system. This issue will become more serious in future years if the City discontinues their practice of providing an annual general fund subsidy for operations, maintenance, and administration. This general fund revenue accounts for nearly one-third of the City's annual budget for transportation operations and is not forecast to continue beyond FYE 2019. The City is aware of this issue and is exploring potential options to create a long-term funding solution for transportation maintenance.

Summary of revenue for roadway capital projects

Exhibit 37 shows the total forecast revenues for transportation capital projects from each jurisdiction. Revenues are expected to increase from \$6.8 million in FYE 2015 to \$18.9 million in FYE 2040. Total revenues are expected to be \$384.6 million over the forecast period, with average annual revenues equal to \$14.8 million.

**Exhibit 37. Projected revenue available for transportation capital projects in BMPO,
FYE 2015 to 2040 (YOE \$)**

FYE	City	ODOT	County	Total
2015	\$ 5,743,773	\$ 1,088,829	\$ -	\$ 6,832,602
2016	\$ 5,951,958	\$ 2,209,289	\$ -	\$ 8,161,247
2017	\$ 11,294,970	\$ 2,230,014	\$ -	\$ 13,524,984
2018	\$ 6,619,470	\$ 2,251,009	\$ -	\$ 8,870,479
2019	\$ 6,962,810	\$ 2,272,276	\$ -	\$ 9,235,086
2020	\$ 7,185,420	\$ 2,150,540	\$ -	\$ 9,335,960
FYE	City	ODOT	County	Total
2021	\$ 7,416,358	\$ 1,215,642	\$ -	\$ 8,632,000
2022	\$ 7,817,129	\$ 1,337,749	\$ -	\$ 9,154,878
2023	\$ 8,225,535	\$ 1,360,143	\$ -	\$ 9,585,678
2024	\$ 13,657,962	\$ 1,382,827	\$ -	\$ 15,040,789
2025	\$ 8,907,434	\$ 1,405,806	\$ -	\$ 10,313,240
2026	\$ 9,170,742	\$ 1,257,001	\$ -	\$ 10,427,743
2027	\$ 9,571,424	\$ 1,352,664	\$ -	\$ 10,924,088
2028	\$ 20,020,484	\$ 1,619,787	\$ -	\$ 21,640,635
2029	\$ 10,513,586	\$ 1,887,221	\$ -	\$ 12,400,807
2030	\$ 20,788,745	\$ 1,215,191,731	\$ -	\$ 22,700,476
2031	\$ 11,116,780	\$ 1,936,560	\$ -	\$ 13,053,340
2032	\$ 51,715,489	\$ 1,755,036	\$ -	\$ 53,470,525
2033	\$ 12,242,793	\$ 1,987,189	\$ -	\$ 14,229,982
2034	\$ 12,793,952	\$ 2,012,998	\$ -	\$ 14,806,950
2035	\$ 13,370,464	\$ 12,039,142	\$ -	\$ 15,409,606
2036	\$ 13,973,918	\$ 2,065,625	\$ -	\$ 16,039,546
2037	\$ 14,604,994	\$ 2,092,453,	\$ -	\$ 16,697,447
2038	\$ 15,264,371	\$ 1,871,406	\$ -	\$ 17,135,777
2039	\$ 15,955,433	\$ 2,147,157	\$ -	\$ 18,113,590
2040	\$ 16,712,292	\$ 2,175,043	\$ -	\$ 18,887,335
Total	\$ 337,609,648	\$ 47,015,137	\$ -	\$ 384,624,785
Average	\$ 12,984,986	\$ 1,808,275	\$ -	\$ 14,793,261

Calculated by ECONorthwest, 2014

Because the timing of future capital improvements is uncertain, it is difficult to take current cost estimates and adjust them for inflation in the future to show them in YOE dollars. Thus, when comparing future project costs with available revenues, it is helpful to focus on the revenue projections in constant 2015 dollars.

Exhibit 38 shows the same forecast of revenues for capital projects in the BMPO, but in constant 2015 dollars. County and State revenues are expected to remain relatively constant over the forecast period, keeping pace with inflation. City revenues, however, are forecast to increase faster than the rate of inflation, due mostly to growth in SDC revenue fueled by new development. In total, we forecast \$252.6 million in revenue (constant 2015 \$) will be available for capital projects between FYE 2015 and 2040.

**Exhibit 38. Projected revenue available for transportation capital projects in BMPO,
FYE 2015 to 2040 (Constant 2015 \$)**

FYE	City	ODOT	County	Total
2015	\$ 5,743,773	\$ 1,088,829	\$ -	\$ 6,832,602
2016	\$ 5,772,995	\$ 2,142,859	\$ -	\$ 7,915,854
2017	\$ 20,625,559	\$ 2,097,849	\$ -	\$ 12,723,408
2018	\$ 6,039,663	\$ 2,053,839	\$ -	\$ 8,093,502
2019	\$ 6,161,799	\$ 2,010,863	\$ -	\$ 9,172,642
2020	\$ 6,167,742	\$ 1,845,857	\$ -	\$ 8,013,699
2021	\$ 6,174,638	\$ 1,012,107	\$ -	\$ 7,186,745
2022	\$ 6,312,792	\$ 1,080,312	\$ -	\$ 7,393,104
2023	\$ 6,442,810	\$ 1,065,358	\$ -	\$ 7,508,168
2024	\$ 10,376,025	\$ 1,050,541	\$ -	\$ 11,426,566
2025	\$ 6,563,579	\$ 1,035,890	\$ -	\$ 7,599,469
2026	\$ 6,554,276	\$ 898,370	\$ -	\$ 7,452,646
2027	\$ 6,634,843	\$ 927,657	\$ -	\$ 7,572,500
2028	\$ 13,461,204	\$ 1,089,079	\$ -	\$ 14,550,283
2029	\$ 6,856,389	\$ 1,230,743	\$ -	\$ 8,087,132
2030	\$ 13,154,944	\$ 1,209,269	\$ -	\$ 14,359,213
2031	\$ 6,820,528	\$ 1,188,148	\$ -	\$ 8,008,676
2032	\$ 30,775,701	\$ 1,044,415	\$ -	\$ 31,820,116
2033	\$ 7,066,548	\$ 1,147,008	\$ -	\$ 8,213,556
2034	\$ 7,162,665	\$ 1,126,973	\$ -	\$ 8,289,638
2035	\$ 7,260,244	\$ 1,107,267	\$ -	\$ 8,367,511
2036	\$ 7,359,729	\$ 1,087,916	\$ -	\$ 8,447,645
2037	\$ 7,460,662	\$ 1,068,886	\$ -	\$ 8,529,548
2038	\$ 7,562,984	\$ 927,219	\$ -	\$ 8,40,203
2039	\$ 7,672,849	\$ 1,031,840	\$ -	\$ 8,704,689,
2040	\$ 7,789,925	\$ 1,013,818	\$ -	\$ 8,803,643
Total	\$ 219,969,746	\$ 32,593,012	\$ -	\$ 252,562,758
Average	\$ 8,460,375	\$ 1,253,577	\$ -	\$ 9,713,952

Calculated by ECONorthwest, 2014

Note that not all of the revenues presented in Exhibit 38 will be available for capital projects on the MTP preferred projects list. There are other projects in the region that are eligible to receive funding from these sources, including local improvements not in the MTP, Intelligent Transportation Systems (ITS) projects, safety improvements, and bicycle and pedestrian projects. The City's Transportation System Development Charges Final Methodology Report identifies \$65 million in SDC funding that is needed for local projects that are not included in the MTP, as well as another \$15 million in SDC funding for bicycle and pedestrian improvement projects. Deschutes County's ITS Plan identifies \$12 million in high and medium priority projects that would need to be funded by the City and ODOT. Safety projects totaling \$4 million are identified in the ODOT Federal Highway Safety Improvement Program (HSIP) Transition Program and the City of Bend Multimodal Traffic Safety Program 2012-2014, and would require City and ODOT funding.

Exhibit 39 shows how the projected revenues for capital projects in the BMPO align with various needs, and the remaining revenue available for capital projects on the preferred

project list in the MTP. We forecast there will be \$156.6 million in revenue available for roadway capital projects in the BMPO between FYE 2015 and 2040, and \$15.0 million for bicycle and pedestrian projects (constant 2015 dollars).

Exhibit 39. Projected use of funds for capital projects in BMPO, FYE 2015 to 2040

	City of Bend	ODOT	Deschutes County	Total
Total Resources	\$ 219,969,746	\$32,593,012	-	\$ 252,562,758
Projects not in MTP				
SDC local improvements	\$ 65,000,000	-	-	\$ 65,000,000
Projects in the MTP				
ITS	\$ 5,000,000	\$ 7,000,000	\$ -	\$ 12,000,000
Safety	\$ 3,000,000	\$ 1,000,000	\$ -	\$ 4,000,000
Stand-Alone Bike/Ped	\$ 15,000,000	\$ -	\$ -	\$ 15,000,000
Roadway	\$ 131,969,746	\$ 24,593,012	\$ -	\$ 156,562,758
Subtotal	\$ 154,970,000	\$ 32,593,000	\$ -	\$ 187,563,000

Calculated by ECONorthwest based on the following sources:

SDC local improvements: City of Bend Transportation SDC Final Methodology Report

ITS: Deschutes County ITS Plan (high and medium priority projects)

Safety: ODOT Federal HSIP Transition Program and City of Bend Multimodal Traffic Safety Program (2012-2014)

Bike/Ped: City of Bend Transportation SDC Final Methodology Report

Roadway: Calculated by ECONorthwest

Note that not all funding can be spent on all projects, and there might be a mismatch between funding sources and capital needs. In particular, our forecast shows substantial funding from SDCs, \$116.2 million out of the total \$252.6 million in revenues for capital projects. These SDC revenues can only be applied to City projects that add capacity to address new development. Conversely, our forecast does not include a lot of funding for State or County-owned roads, or to address existing system deficiencies.

Transit service

There is significant uncertainty regarding long-term projections for transit funding and expenditures, given the relatively short operating history of CET, and the different options under consideration for future service improvements.

In January 2014, a CET Local Dedicated Public Funding Subcommittee, appointed by the COIC Board, made recommendations on local public funding options for CET. These recommendations included a two-phased approach, where CET would continue to rely on agreements with cities and counties to provide funding for a base level of service in the short-term (0-3 years). In phase 2 (3-5 years), CET should develop a dedicated, local, publicly-funded tool to achieve sustainable and convenient service levels across the region. The preferred funding tool would be a region-wide property tax, but that other tools may ultimately prove more feasible or desirable. This proposed, new, dedicated funding source would either replace existing contributions from local jurisdictions, or would enhance the level of service in jurisdictions that choose to continue providing additional funding.

Ultimately, the long-term projections of revenues and expenditures for CET will depend on the level of service that CET chooses to provide, and the amount of permanent local funding that CET is able to obtain.

Chapter 20: Performance & Mobility Measures

Performance & Mobility Measures
Chapter to be completed at a Later Date

Chapter 21: Outstanding Issues

Introduction

This MTP update is intended to conform with state and federal requirements; to reflect changes to the MPO's transportation network; and update existing and planned future land uses and socioeconomic characteristics that have occurred since the adoption of the previous plan in 2007. It also integrates recently completed regional transit and ITS plans into the MTP. It has produced a new financially constrained project list that is based on updated travel demand projections as well as an updated revenue and financial forecast for what transportation funding is expected to be available over the planning horizon.

This update is not intended to be an intensive update of all elements of the plan as was completed in 2007. It is expected that the land use patterns within the MPO (which is a fundamental assumption that drives transportation needs) will be revised in the next few years as part of the City of Bend's current Urban Growth Boundary update efforts. Once that is complete and a new future land use pattern and UGB boundary is established, a comprehensive update of the BMPO's MTP can be completed to be consistent with those land use plans, including the Bend Area General Plan and the Bend Transportation System Plan. This effort will be a focused update of the current MTP to conform with state and federal requirements, reflect changes and work completed since the current plan's adoption, and, to the extent possible, incorporate goals of the latest federal transportation bill (MAP-21).

Stage II MTP Development

The Stage II MTP update will begin in early 2015. This update will:

- Include a more comprehensive public involvement that involves a broader range of stakeholders and interested parties.
- Assess the finding and projects outlined in this Stage I (September 2014) Update based on the new Redmond-Bend regional travel demand model that is currently being developed and make updates as needed.
- Update the MTP for additional MAP-21 requirements as they become clear.
- Address additional concepts desired by the partnering agencies such as Alternate Mobility Standards and more in depth evaluation of the needs of US97 (Parkway) and US20 in the BMPO area.
- Provide a detailed update of the Security section. A key component of this update will be to address the transport of hazardous material through the MPO area.
- Update the Goals, Objectives, & Performance measures upon which the plan priorities are based.

Key Outstanding Issues for Future Planning

The improvements, funded and unfunded, called for in this Plan do not solve all of the identified transportation issues. In fact, some of the more obvious issues are not fully addressed by the improvements identified in this Plan. The reasons for this are:

- 1) The nature of these issues is very complex and further analysis is required to adequately understand the underlying travel demand contributing to the issues;
- 2) Several potential approaches might be useful, either alone or in combination, to address these issues;
- 3) The lack of funding available to implement the solutions, or restrictions on the funds available that preclude their use in being applied toward a particular issue;
- 4) No consensus solutions are currently identified to address these issues, and additional public deliberation and input is required before a preferred alternative can be selected and included in the Plan; and
- 5) Several of these issues are the subjects of current ongoing planning studies and as such do not have any recommended solutions at this time.

This chapter summarizes the outstanding issues that were identified in the preceding chapters, along with some broader issues facing the region. In addition to those outstanding issues discussed below, other problem areas will likely be the subject of further study as part of the development of local Transportation System Plans by jurisdictions in the region, or as part of specific study processes associated with updating local comprehensive land use plans.

Although interrelated packages of improvements for each of these outstanding issues will likely be identified as a result of the ongoing planning studies, there may be instances where specific projects or actions to preserve right(s)-of-way for eventual improvements are warranted prior to the completion of the entire study. If such actions can successfully demonstrate consensus support and operational separability (i.e., the action or improvement is warranted on its own merits and will not preclude elements of a comprehensive solution), then they may be advanced individually and remain consistent with this Plan without being specifically identified in it.

Bend Urban Growth Boundary

The City of Bend is assessing its needs for economic and residential lands for the next 20 years. The goal is to ensure Bend satisfies Oregon state planning laws with a 20 year supply of buildable land inside its Urban Growth Boundary (UGB) for needed housing and employment. In April 2009, the City and Deschutes County submitted a jointly adopted Urban Growth Boundary expansion map and supporting materials to the Oregon Department of Land Conservation and Development (DLCD) for review. In November of 2010, the Land Conservation and Development Commission (LCDC) issued its final order remanding the decision back to the City for work and revision consistent with the order. Since March of 2011, the City has completed a number of the tasks required in the remand and just recently started a more intensive public involvement process to complete this work. This process began in 2014 and is expected

to extend to 2016. The current goal is local adoption of a final UGB proposal in April of 2016. The outcome of the UGB expansion could have profound impacts on the transportation system. Upon completion of the UGB expansion process, the MTP will need to be reviewed and revised.

Funding Issues

As can be seen in the preceding chapters, the region is facing a shortfall in revenues when compared with the projects that have been identified as being needed and in regards to operating and maintaining the existing system. This shortfall impacts all aspects of the transportation system, from the roads and highways, to the operation of bus service. With no solution to the dilemma of decreasing resources, the area will need to make do with reduced levels of maintenance of roads and bridges, increasing congestion, and constrained transit services.

As shown in the financial chapter of this Plan, there is a considerable difference between the amount of revenues that will be available to the region during the horizon of this Plan and the costs of the improvements necessary to address all the issues that face the transportation system. The financially constrained selection of projects presented in the previous chapters addresses the federal planning requirements related to financial constraint.

Alternate Mobility Standards/Performance Measures

Current policies of the City of Bend and ODOT use traditional traffic operations performance measures (delay and volume-to-capacity ratios) to evaluate system performance. In recent years, many agencies (including those in central Oregon) have expressed interest in evolving the manner in which the transportation system performance is measured and evaluated. The main goal of this evolution is capture the needs of the broad range of transportation users (drivers, cyclists, pedestrians, transit riders, freight) and to capture other priorities, such as safety, and incorporate these in the performance evaluation. Recent planning efforts in central Oregon, such as TRIP97, have taken initial steps in assessing alternate standards and performance measure that will allow stakeholders to more effectively monitor, plan for, and invest in the transportation system. It's the MPO's goal to continue this discussion among MPO partners to establish a more holistic set of transportation performance measure for the MPO area that are reflective of the communities goals and priorities.

Rail

Rail issues include the safety of railroad crossings, traffic congestion associated with rail crossing closures, and at-grade rail crossing impacts on emergency services. Forecast future increases in the number of trains will only exacerbate these issues. Efforts should be focused on providing alternate routes, construct overcrossings, and enhancing the safety of at-grade crossings.

Other outstanding issues that cannot be fully addressed by this document include: 1) the preservation of land that is currently capable of being served by rail and noise associated with the trains, and 2) the study/evaluation of moving the rail line to the east of the current urban growth boundary.

Roads

As outlined in the Motor Vehicles chapter, there is limited funding to address all of the roadway system needs identified. A prioritized list of reasonably funded projects had to be developed with the remaining needs outlined on an aspirational (but unfunded list). That is not to say that these needs are not important; they are captured in the aspirational list so that they can be addressed as additional funding or funding partnerships become available or if priorities of which projects should be on the funded list evolve. Key areas of note that still remain on the unfunded needs are:

- US 97 at the north end of Bend (unfunded improvements identified in the US 97 North Corridor EIS)
- US 20 at the north end of Bend (potential for future funding for improvements through land development)
- Central City congestion
- Greenwood-US 20 from 3rd Street to Pilot Butte
- Bend Parkway (see discussion below)

Bend Parkway Study

As with previous long range planning efforts, this MTP update identified future traffic congestion and constraints for the Bend Parkway to meet current mobility standards in the future. The Bend Parkway is a heavily used transportation facility through the MPO area and serves a significant volume of commercial, commuter, and recreational traffic within the Bend MPO as well as through central Oregon. There will be limited options for adding traditional lane capacity to the Parkway in the future due to financial constraints, physical constraints, and community values. A priority for future study will be a refined planning effort for the Bend Parkway to determine what capacity, efficiency, and safety measures can be implemented to maintain safe and effective transportation performance on the facility in the future.

A key component of this Parkway study will be the evaluation and recommendation for improvements to the Powers Road area. As discussed in Chapter 6, the long range forecast indicates the needs for capacity, connectivity, and safety improvements at the existing Powers Road interchange with the Parkway. Funding constraints do not allow for full funding of an improvement here with the currently projected revenue from State sources and more detailed study is required to determine what the best solution for the area will be. Focus on the Powers Road area is recommended as part of the study to resolve these issues and provide a comprehensive solution.

Pedestrian and Bicycle Projects

The majority of the future pedestrian and bicycle projects were assumed to be completed with the funding allocated to the City's future local transportation projects as part of this update to the MTP. As noted in Chapter 7, the City of Bend and the Bend MPO are in the process of developing the *Strategic Implementation Plan for Walking and Biking Infrastructure*. When completed, it will outline a strategy for incorporating bicycle and pedestrian focused projects into the City's Capital Improvements Plan (CIP). To date, the effort has identified five "Pedestrian Zones" where walkable areas have the most potential. The zones were prioritized against each other and specific projects identified for the top three zones. The City has received project ideas from the public related to upgrading/completing existing facilities, improving crossings of multi-lane roads, and creating new connections within these zones. The plan is also identifying important corridors where accessibility improvements are needed. The final outcomes of this Plan should be reviewed during Phase II to determine if some projects (including sidewalks, major roadway crossings, bicycle facilities, etc.) should be incorporated into the Preferred Plan as individual projects rather than the City's allocation for future local improvements.

Increasing Reliance on Non-Automobile Modes

The Oregon Transportation Planning Rule (TPR) requires that the MPO and the local jurisdictions in the urban area develop measures and benchmarks that will demonstrate that the Bend area is increasing its reliance on non-automobile modes. It is believed that land use changes will be required in order to facilitate this change from the status quo. Upon completion of the Bend UGB expansion, analysis will likely be initiated to examine the use of mixed land use centers, corridors, and high transit service levels as methods for reducing automobile reliance. These studies will be designed as the basis for meeting the TPR requirement for the area jurisdictions to develop an "integrated land use/transportation plan." The types of measures that may be considered to demonstrate increased non-auto reliance include: the number of people who live within a ¼-mile walk to a transit stop; non-auto mode share; number of dwellings close to retail services and employment. In terms of the development of the MTP, recent guidance has reinforced the federal mandate that the MPO plan be based upon *currently adopted Local Comprehensive Land Use Plans*, including only those land uses and developments that can be considered likely to occur over the planning horizon.

The BMPO *can*, however, provide modeling outputs useful in the evaluation of alternative future land use scenarios, *if such outputs are requested and defined by a member jurisdiction, and those local comprehensive land use plan changes are in the pipeline for adoption by the affected local jurisdiction.*

APPENDIX A

Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) Compliance Matrix

**Achieving SAFETEA-LU Compliance
Bend Metropolitan Planning Organization
Final – August 2, 2007**

SAFETEA-LU Requirement		General Expectation	Recommendations for SAFETEA-LU Compliance
			Name of MPO: BMPO
1.	Metropolitan Transportation Plan Cycle	Maximum Plan Cycles: 4 Yr Plan Air Quality Areas 5 Yr Plan Otherwise	<p><i>Current status: SAFETEA-LU compliant plan (2007-2030 MTP) adopted on June 27, 2007.</i></p> <p>Recommendation: Next major plan update would be scheduled for completion in June 2012. Several local projects (including but not limited to the City of Bend UGB expansion, US97 North Corridor EIS, S Parkway IAMP, and the Juniper Ridge Master Plan) could necessitate a major update in the next 1-2 years.</p>
2.	MTIP Cycle and Scope	Max MTIP Cycle = 4yrs Min MTIP Scope = 4yrs	<p><i>Current status: 2006-2009 MTIP adopted June 16, 2005. MTIP has 2 year cycle and 4 year scope.</i></p> <p>Recommendation: Next MTIP (2008-11) will have 4 year scope and 2 year cycle (consistent with ODOT). Scheduled for adoption in September/October 2007 (will be SAFETEA- LU compliant)</p>
3.	Air Quality Conformity	Designated air quality non-attainment areas must prepare conformity determinations for the plan and MTIP.	<p><i>Current Status: Not applicable to the BMPO (not a designated air quality non-attainment area)</i></p> <p>Recommendation: Not applicable</p>
4.	Environmental Mitigation	Plans must identify environmental resources; discuss mitigation issues and activities; and document supporting consultation with	<p><i>Current status: The 2007-2030 MTP includes an Environmental Considerations chapter. The chapter identifies natural, historic, and cultural resources, mitigation issues, policies, and recommended actions. The chapter also identifies data gaps and recommended next steps. The draft chapter was presented to the ODOT Collaborative Environmental Transportation Agreement for Streamlining (CETAS) group at their May 2007 meeting. Additionally, several meetings were held with local resource agencies (ODFW, USFS, ODEQ, County Historic Resources Planner, etc).</i></p>

SAFETEA-LU Requirement		General Expectation	Recommendations for SAFETEA-LU Compliance Name of MPO: BMPO
		relevant Federal, State, wildlife, land management, and regulatory agencies.	<p><i>The Technical Advisory Committee currently includes representatives from the Department of Land Conservation and Development and the Oregon Department of Environmental Quality.</i></p> <p>Recommendation: As possible, the BMPO will expand consultation to include applicable federal and state agencies and others. Other agencies within the region are currently evaluating storm water issues, including green streets. As that work is completed, the BMPO will consider inclusion of applicable elements in the MTP.</p>
5.	Expanded Consultation	Expand existing consultation of the Plan to include State and local agencies responsible for land use mgmt, natural resources, environmental protection, conservation and historic preservation.	<p><i>Current status: BMPO currently coordinates with the City of Bend, Deschutes County, DLCD, ODEQ, Bend-La Pine Schools, Central Oregon Community College, and the Central Oregon Intergovernmental Council.</i></p> <p><i>Consultation with regards to land use occurs in a variety of ways. MPO staff has been involved in the City of Bend Urban Growth Boundary (UGB) expansion planning process and Urban Reserves (UR) planning process. This has included the identification of potential future mixed-use sites and multi-modal transportation system improvements. After the UGB and UR expansions are completed, MPO staff will be involved in further evaluating the impacts of potential mixed-use sites and multi-modal corridors.</i></p> <p><i>There is policy language on environmental resources and associated activities in the MTP. There are policies and related strategies dealing specifically with consulting with state and federal agencies, including natural resource agencies.</i></p> <p><i>Consultation during MTP development included a presentation to and discussion with the ODOT Collaborative Environmental and Transportation Agreement for Streamlining (CETAS) group and meetings with the ODFW, USFS, and ODEQ. Additionally, letters and e-mail messages were sent and phone calls were made to the USDA Forest Service, Bureau of Land Management, U.S. Environmental Protection Agency, US Fish and Wildlife, US Army Corps of Engineers and many other local, state, and national agencies. The letters explained the role of the MTP, SAFETEA-LU's guidance for consultation in the area of environmental mitigation, and ways in which the MTP could meet consultation expectations with natural resource agencies.</i></p>

SAFETEA-LU Requirement		General Expectation	Recommendations for SAFETEA-LU Compliance Name of MPO: BMPO
			Recommendation: BMPO will expand existing consultation to include applicable federal, state, and local agencies, commissions, and special districts.
6.	Planning Factor: Promote consistency with State and local planned growth and economic development patterns.	Planning process and plan must consider projects and strategies that will promote consistency with growth and development patterns.	<p><i>Current status: This is standard practice for the BMPO. BMPO staff has been involved in the City of Bend UGB and UR planning processes. BMPO staff will be involved in future evaluations of potential mixed-use centers and multi-modal corridors in the UGB and UR area. The MTP also identifies the importance of transportation to the economic vitality of the region.</i></p> <p>Recommendation: Continue with current practice</p>
7.	Planning Factor: Increase the security of the transportation system for motorized and non-motorized users.	Planning process and plan must consider projects and strategies that will increase the security of the system for its users.	<p><i>Current status: The adopted 2007-2030 MTP includes a Security chapter. The chapter identifies potential issues, policies, and recommended actions. The chapter also identifies data gaps and recommended next steps.</i></p> <p><i>The MTP and its associated policies recognize the importance of planning, building, operating and maintaining the transportation system so that it is secure for all modes and all system users. The MTP recognizes that it is especially important to be consistent with the leadership of federal, state and local homeland security entities and recognizes the need to deter, detect, defend and design in order to protect transportation facilities and users.</i></p> <p>Recommendation: As additional information and guidance becomes available, updates will be made to the Security chapter. Additionally, BMPO staff will evaluate opportunities for better involvement in local, regional, and statewide security planning efforts.</p>
8.	Planning Factor: Increase the safety of the transportation system for motorized and non-motorized users.	Planning process and plan must consider projects and strategies that will increase the safety of the system for its users.	<p><i>Current status: The adopted 2007-2030 MTP includes a Safety chapter and Existing Conditions chapter. The Safety chapter identifies potential issues, policies, and recommended actions. The chapter also identifies data gaps and recommended next steps. The Existing Conditions chapter includes a detailed assessment of crash data from throughout the study area and identifies high crash locations.</i></p> <p><i>Safety is a primary goal for the BMPO and its member agencies. ODOT places safety</i></p>

SAFETEA-LU Requirement		General Expectation	Recommendations for SAFETEA-LU Compliance Name of MPO: BMPO
			<p>for users of the transportation system at the highest level of its plan priorities. The City of Bend has an active Traffic Safety Advisory Committee and Safe Routes to Schools advisory committee.</p> <p>Additionally, the City of Bend has a policy to implement roundabouts instead of signals unless it can be shown that a roundabout is not feasible. The City now has an almost equal number of roundabouts and signals. Crash data indicate that crash rates and crash severities are far lower at roundabouts.</p> <p>The MTP recognizes safety as a critical challenge. While the overall safety numbers are improving in Oregon, attention to safety must always be a priority.</p> <p>BMPO staff is also tracking development of the ODOT Strategic Highway Safety Plan (SHSP). When completed, BMPO staff will evaluate opportunities for incorporating applicable components of the SHSP into the MTP.</p> <p>Recommendation: The City of Bend is considering funding a series of corridor safety audits. As that discussion progresses, BMPO staff will participate and help identify corridors for study, funding opportunities, and ultimately implementation strategies. Additionally, BMPO staff will evaluate opportunities for better involvement in local, regional, and statewide safety planning efforts.</p>
9.	Operational and Management Strategies	The plan should specifically address the identification and implementation of TSM/TDM strategies.	<p>Current status: The adopted 2007-2030 MTP includes a Transportation Systems Management chapter and a Transportation Demand Management chapter.</p> <p>Systems management seeks to improve the efficiency of the transportation system by optimizing the existing transportation infrastructure capacity with improved operations and management. The chapter identifies potential issues, policies, and recommended actions. It also identifies data gaps and recommended next steps. There is also an ITS Plan for central Deschutes County. Much of the content of the ITS Plan was incorporated in the TSM chapter.</p> <p>The TSM chapter promotes removing barriers and bringing innovative solutions together so that the transportation system functions as smoothly as possible. Effective management of the transportation system between jurisdictions and system providers</p>

SAFETEA-LU Requirement		General Expectation	Recommendations for SAFETEA-LU Compliance Name of MPO: BMPO
			<p><i>is also critical to achieving the goal of efficient system management and operations. System optimization is also identified in the chapter.</i></p> <p><i>The TDM chapter discusses new approaches to implementing demand management techniques. It also includes a lengthy list of policies encouraging demand management at many different levels.</i></p> <p><i>The MTP recognizes the growing challenges of increased system demands and growing congestion coupled with limited funding for transportation system improvements. These challenges make it vital to effectively manage and operate existing infrastructure as a way to optimize the system.</i></p> <p><i>Recommendation: The regional ITS working group will be reconvening in FY07-08 to review the ITS Plan and identify needed updates and implementation options. If that plan undergoes significant revisions, the MTP will be amended as needed. Additionally, rapidly escalating project costs will greatly limit capacity improvements in the coming years. Opportunities for maximizing operational and management strategies will be critical. BMPO staff will work with member agencies/jurisdictions to identify operational and management strategies.</i></p> <p><i>Additionally, funding has been programmed for the first phase of the highest priority project identified in the ITS Plan. That project (Central Signal System) could provide significant operational improvements throughout the study area. BMPO staff will track that project and work with the project team to identify funding opportunities to fully implement the project.</i></p>
10.	Public Participation Plan	MPOs are to develop, adopt and utilize "participation plans". These plans are to: <ol style="list-style-type: none"> 1. Provide reasonable opportunities for 	<p><i>Current status: The BMPO developed a draft Public Participation Program (PPP) in FY06-07. That draft plan was reviewed by the Citizen Advisory Committee and the Policy Board. It was also posted on the BMPO website. The Policy Board opened the public comment period on the draft plan. At the same time, other MPOs in Oregon developed and adopted PPPs during FY06-07. Those plans contain a series of best practices for public participation. The draft PPP was not adopted. Staff determined it was best to update the draft PPP to include these best practices from other MPOs. The BMPO PPP should be completed and adopted during the first quarter of FY07-08.</i></p>

SAFETEA-LU Requirement		General Expectation	Recommendations for SAFETEA-LU Compliance
			Name of MPO: BMPO
		<p>interested parties (including users of transportation services and recipients of transportation assistance) to comment on the plan and TIP;</p> <p>2. Be developed in consultation with all interested parties; and</p> <p>3. Afford participants an opportunity to comment on the plan and MTIP prior to approval.</p>	<p><i>The MTP development process provided frequent and accessible opportunities for all interested parties to participate and provide comments on the draft MTP chapters. Many opportunities were presented through the BMPO committee process – Policy Board, Technical Advisory Committee, and Citizen Advisory Committee. Representatives of various stakeholder groups including public agencies such as the Department of Land Conservation and Development, members of the freight community, transportation demand management representatives, and many other interested parties serve on these committees. A complete list of committee members is available in the MTP.</i></p> <p><i>The OTP underwent a public outreach and review process. Staff made presentations during initial MTP development to a few interested groups. Staff provided public notification announcing completion of draft chapters, the public hearing process, and adoption. These notifications were provided to local and regional media, public agency staff, interested private sector parties, and interested citizens.</i></p> <p><i>Draft components of the MTP were posted on the BMPO website during the planning process. The website contained the draft chapters, maps, committee meeting information, and contact information.</i></p> <p><i>In addition to feedback at the meetings, staff received written comment (letters and emails) from public agencies and a few interested parties. BMPO staff updated the MTP in response to the comments received.</i></p> <p><i>Public notice of the public hearing was distributed to interested parties. The BMPO Policy Board received additional comments at public hearings held on June 21 and June 27, 2007. The BMPO Policy Board adopted the MTP on June 27, 2007.</i></p> <p>Recommendation: Update the draft PPP to include the best practices included in other PPPs. Hold a public review and comment period and adopt the PPP in the first quarter of FY2007-08.</p>
11.	Public Meetings	In carrying out the public participation	<i>Current status: This is standard practice for the BMPO. Much of the MTP outreach process occurred at regularly scheduled meetings for the various BMPO committees.</i>

SAFETEA-LU Requirement		General Expectation	Recommendations for SAFETEA-LU Compliance Name of MPO: BMPO
		plan, public meetings are to be conducted at convenient and accessible locations at convenient times.	<p><i>Meetings of the Policy Board and Citizen Advisory Committee are held in the late afternoon and early evening, respectively. These meetings are held in accessible locations.</i></p> <p><i>Additionally, "Accessible Meeting Information" is included on the meeting agendas for all BMPO meetings. The information indicates that the meeting location is physically accessible, that communication or other accommodations for people with disabilities will be made upon advance request. The information also identifies a process and contact information to request accommodations.</i></p> <p>Recommendation: Continue with current practice</p>
12.	Process to provide reasonable comment opportunities to expanded list of interested parties.	MPO to provide representatives of users of pedestrian walkways and bicycle transportation facilities, representatives of the disabled with reasonable opportunity to comment on transportation plan.	<p><i>Current status: The BMPO developed a draft Public Participation Program (PPP) in FY06-07. That draft plan was reviewed by the Citizen Advisory Committee and the Policy Board. It was also posted on the BMPO website. The Policy Board opened the public comment period on the draft plan. At the same time, other MPOs in Oregon developed and adopted PPPs during FY06-07. Those plans contain a series of best practices for public participation. The draft PPP was not adopted. Staff determined it was best to update the draft PPP to include these best practices from other MPOs. The BMPO PPP should be completed and adopted during the first quarter of FY07-08.</i></p> <p><i>The MTP development process provided frequent and accessible opportunities for all interested parties to participate and provide comments on the draft MTP chapters. Many opportunities were presented through the BMPO committee process – Policy Board, Technical Advisory Committee, and Citizen Advisory Committee.</i></p> <p><i>Key staff and members of the regional Bicycle and Pedestrian Advisory Committee (BPAC) are also members of the Technical Advisory Committee. Development of the Bicycle and Pedestrian chapter was closely coordinated with and linked to the city, county, and parks and recreation district bicycle and pedestrian planning efforts.</i></p> <p><i>The MTP underwent a public outreach and review process. Staff made presentations during initial MTP development to a few interested groups. Staff provided public notification announcing completion of draft chapters, the public hearing process, and adoption. These notifications were provided to local and regional media, public agency</i></p>

SAFETEA-LU Requirement		General Expectation	Recommendations for SAFETEA-LU Compliance Name of MPO: BMPO
			<p>staff, interested private sector parties, and interested citizens.</p> <p>Draft components of the MTP were posted on the BMPO website during the planning process. The website contained the draft chapters, maps, committee meeting information, and contact information.</p> <p>In addition to feedback at the meetings, staff received written comment (letters and emails) from public agencies and a few interested parties. BMPO staff updated the MTP in response to the comments received.</p> <p>Public notice of the public hearing was distributed to interested parties. The BMPO Policy Board received additional comments at public hearings at meetings held on June 21 and June 27, 2007. The BMPO Policy Board adopted the MTP on June 27, 2007.</p> <p>Recommendation: Update the draft PPP to include the best practices included in other PPPs. Hold a public review and comment period and adopt the PPP in the first quarter of FY2007-08.</p>
13.	Visualization Techniques	Development of the transportation plan and MTIP shall, to the maximum extent practicable, employ visualization techniques.	<p><i>Current status: The BMPO currently employs a variety of visualization techniques such as: GIS, PowerPoint, newspaper display ads, etc. A variety of visualization techniques were used to develop and present the MTP transportation needs information, financial analysis and policy implications. This included maps, tables, diagrams, charts and figures to illustrate a result or concept.</i></p> <p><i>The regional transportation model was used to identify future needs and possible future improvement options. Model plots were used to show the outputs of the model and helped convey future issues to the Policy Board, other committees, and the public.</i></p> <p><i>System maps were developed for the existing conditions report and the environmental considerations chapter. The maps show locations of various transportation facilities including airports, highways, bike lanes, sidewalks, and railroads. The maps also show many aspects of the natural and cultural environments.</i></p>

SAFETEA-LU Requirement		General Expectation	Recommendations for SAFETEA-LU Compliance Name of MPO: BMPO
			<p><i>The current practice of using visualization techniques for planning activities is increasing. In the future, additional maps and other visualization tools should be readily available to policy makers and the public.</i></p> <p>Recommendation: The BMPO will continue with the current practice and evaluate other options (e.g. before/after images and simulations).</p>
14.	Electronic access to plans	MPOs should publish and make available on the internet its plans and MTIP. MPOs shall also make public information available in electronically accessible format and means, such as the World Wide Web, as appropriate.	<p><i>Current status The BMPO has a website where the public can access Policy Board and committee materials, the MTIP and the completed MTP: http://www.ci.bend.or.us/depts/community_development/bend_metropolitan/index.html</i></p> <p><i>The site provided convenient opportunities for contacting staff and providing comments on the MTP. The adopted MTP is located on the website, along with some support materials developed for the MTP which may be of interest or useful for other applications.</i></p> <p>Recommendation: The BMPO will continue to keep the website up-to-date. The BMPO will also be updating the layout and format of the website to insure compliance with the requirements of the ADA.</p>
15.	Electronic publication of plan	MPOs shall publish or otherwise made readily available for public review transportation plans including (to the maximum extent practicable) in electronically accessible formats such as the World Wide Web.	<p><i>Current status The BMPO has a website where the public can access Policy Board and committee materials, the MTIP and the completed components of the MTP, http://www.ci.bend.or.us/depts/community_development/bend_metropolitan/index.html</i></p> <p>Recommendation: The BMPO will continue to keep the website up-to-date. The BMPO will also be updating the layout and format of the website to insure compliance with the requirements of the ADA.</p>
16.	Congestion Management Process	Transportation Management Areas are to develop and utilize Congestion	<p><i>Current status: Not applicable to the BMPO (not a TMA)</i></p> <p>Recommendation: Not applicable</p>

SAFETEA-LU Requirement		General Expectation	Recommendations for SAFETEA-LU Compliance Name of MPO: BMPO
		Management Processes (formerly Congestion Management Systems) in the development of their plans and MTIP	
17.	TMA Certification Cycle	Transportation Management Areas are to have certification reviews at least every four years.	<p><i>Current Status: Not applicable to the BMPO (not a TMA)</i></p> <p>Recommendation: Not applicable</p>
18.	Coordinated Public Transit/ Human Services Transportation Plan	<p>As a prerequisite to receiving FTA funds for:</p> <ol style="list-style-type: none"> 1.Special Needs and Elderly. 2.Job Access and Reverse Commute. 3.New Freedom <p>Proposed projects must come from a public transit/human services transportation plan.</p>	<p><i>Current status: In Oregon, the Department of Transportation required each county to develop the Coordinated Public Transit/ Human Services Transportation Plan ("the plan"). Through the Oregon Solutions Program, the State of Oregon funded a public transportation coordination project in Deschutes County. The work completed through this project provided the information needed for the plan. The Central Oregon Intergovernmental Council developed the plan with assistance from Deschutes County, City of Bend, City of Redmond, ODOT, and many providers of special transportation services. The BMPO was actively involved in development of the plan. The plan was completed and adopted by the Deschutes County Board of Commissioners in late June 2007.</i></p> <p>Recommendation: Because the plan was not completed until late June, the findings of the plan were not incorporated in the Metropolitan Transportation Plan (MTP). During FY07-08, the BMPO will amend the MTP to include applicable components and findings from the plan.</p>
19.	Addition of transit operator in the development of funding estimates for the financial component of the plan.	Development of estimates of funds that will be available to support plan implementation must be a cooperative	<p><i>Current status: This is standard practice for the BMPO. The transit operator (the City of Bend) was included throughout development of the Metropolitan Transportation Plan, including development of the long-range financial forecasts and system costs.</i></p> <p>Recommendation: Continue with current practice</p>

SAFETEA-LU Requirement		General Expectation	Recommendations for SAFETEA-LU Compliance Name of MPO: BMPO
		effort among the MPO, State and transit operators.	
20.	Congestion Management Process	Transportation Management Areas are to develop and utilize a Congestion Management Processes (formerly Congestion Management Systems) in the development of their plans and MTIP.	<p><i>Current Status: Not applicable to the BMPO (not a TMA)</i></p> <p>Recommendation: Not applicable</p>
21.	Intermodal connectors added as transportation facility.	Plan is to include identification of transportation facilities (including roadways, transit, multimodal and intermodal connectors)	<p><i>Current status: The adopted MTP identifies transportation facilities (including roadways, transit, bicycle facilities, pedestrian facilities, air facilities, rail lines, and pipelines). Currently, there are very few multimodal and intermodal connectors in the study area. As the region grows, it is expected that the number of multimodal and intermodal connectors will grow both in number and importance to the larger transportation system.</i></p> <p>Recommendation: The MTP considers all modes of transportation. Future updates to the MTP will evaluate the presence of new intermodal and multimodal connectors and the need for new intermodal and multimodal connectors. The need for and location of multimodal connectors will be particularly important as the region begins to evaluate and plan for long-term public transportation system improvements.</p>
22.	Plan to include accessible pedestrian walkways and bicycle facilities.	The plan is to provide for the development and integrated management and operation of transportation	<p><i>Current status: The MTP considers all modes of the regional transportation system, including bicycle and pedestrian facilities, as a single, integrated system. Several goals and policies speak to the development, management and operation of an integrated system. The MTP also recognizes that the regional transportation system is part of a broader regional and national. Maintaining good access to those systems and supporting state and federal efforts to improve them is important to the Bend MPO.</i></p>

SAFETEA-LU Requirement		General Expectation	Recommendations for SAFETEA-LU Compliance Name of MPO: BMPO
		systems and facilities (including accessible pedestrian walkways and bicycle transportation facilities)	Recommendation: The MTP considers all modes of transportation. Future updates to the MTP will evaluate the strategies to insure development and integrated management and operation of the region's transportation systems and facilities.
23.	Plan to distinguish between operations and capital investments by including separate operational and management strategies.	Plan must identify operational and management strategies to improve the performance of existing transportation facilities to relieve vehicular congestion and maximize the safety and mobility of people and goods and capital investment and other strategies to preserve the existing and projected future metropolitan transportation infrastructure	<p><i>Current status: The adopted 2007-2030 Metropolitan Transportation Plan (MTP) includes operational and management strategies to improve the performance of existing transportation facilities. These strategies are primarily located in the TSM chapter. The MTP also includes several capital projects that will help preserve the existing infrastructure by providing improving connectivity and providing new travel routes.</i></p> <p><i>Additionally, the long-range financial forecast explicitly considered long-term operations and maintenance costs of the existing system. These costs were deducted from the revenue forecast and assumed to be committed to long-term operations and maintenance costs.</i></p> <p>Recommendation: The adopted MTP includes strategies to preserve and improve the existing system. Future updates to the MTP will evaluate the strategies and financial assumptions to insure adequate provisions are in place to preserve the system.</p>
24.	Due consideration of other planning activities required.	Metropolitan transportation plans and the MTIP are required to be developed with due consideration of other related	<p><i>Current status: Development of the MTP complied with this requirement. As the BMPO developed the MTP, consideration was given to the many studies currently underway including local and state corridor studies, local land use refinement studies, and updates to the state's plans and planning requirements. The outcomes of the many local and regional studies currently underway in the region could significantly impact the MTP and require amendments.</i></p>

SAFETEA-LU Requirement		General Expectation	Recommendations for SAFETEA-LU Compliance
			Name of MPO: BMPO
		<p>planning activities within the metropolitan area.</p> <p>In addition, SAFETEA authorizes a new categorical program for highway safety, the Highway Safety Improvement Program (HSIP). This program, to be administered by the State DOT, requires the development of a State strategic highway safety plan.</p>	<p>Safety is one of the 8 planning factors in SAFETEA-LU. The MTP includes a safety chapter.</p> <p>Recommendation: Continue with current practice. The BMPO will coordinate as appropriate with all member agencies and jurisdictions. In the short-term, the BMPO will coordinate as follows:</p> <p>1) ODOT</p> <ul style="list-style-type: none"> -Development of the strategic highway safety plan -Development of the South Parkway Interchange Area Management Plan -Development of the US97 North Corridor EIS -Development of the US20 Refinement Plan (for east Bend area) -Possible development of a US20 Bend-Sisters Refinement Plan <p>2) Deschutes County</p> <ul style="list-style-type: none"> -Update of the County Transportation System Plan, including development of a county-wide travel demand model -Designation of Urban Reserves around Bend <p>3) City of Bend</p> <ul style="list-style-type: none"> -Designation of an expanded Urban Growth Boundary -Designation of Urban Reserves -Possible development of a NE Bend Transportation Refinement Plan -Development of the Juniper Ridge Master Plan -Development of various corridor studies/plans

APPENDIX B

Oregon Transportation Planning Rule (TPR) Compliance Matrix

TPR Matrix to be completed at a Later Date

APPENDIX C

Existing Conditions Documents

This Existing Conditions chapter was prepared for the original 2007 MPO MTP and was not updated during the 2014 update. Therefore, this Appendix reflects the existing conditions as of 2007. It will be updated during the next comprehensive MPO MTP update, after completion of the Bend UGB expansion.

Bend Dial-a-Ride Classification

General Public: Anyone that is registered over the phone without an application, over 18, not senior, disabled or low income.

Youth: Anyone that has an approved application on file and is 10-17.

Disabled: Anyone that has an approved application on file, and is certified by either a case manager or physician. (No longer use this category except for clients that were registered before 2002).

Honored Citizen: Anyone that has an approved application on file and is over 60.

Senior: Anyone that has an approved application on file and is over 60 (We no longer use this category except for clients that were registered before 2002).

Other: Escorts, Children under the age of 10 and Personal Care Attendants riding with a paying client.

Low Income: Anyone that has an approved application on file, and is receiving food stamps.

Medicaid: Trips must be assigned from COIC (Broker) for authorized trips.

Roadway Functional Classification

<i>Roadway</i>	<i>From</i>	<i>To</i>	<i>Classification</i>
City of Bend Classification			
Business 97 (3Road St.)	Greenwood Avenue	Highway 20/Highway 97 south junction	Principal Arterial
Reed Market Road	Brookwood Blvd.	SE 27th St.	Major Arterial
27th St.	Reed Market Road	Butler Market Road	Major Arterial
Empire Ave.	Highway 20	Purcell Blvd.	Major Arterial
Reed Market Road	Century Drive	Brookwood Blvd.	Minor Arterial
Cooley Road	Highway 20	NE 18th St.	Minor Arterial
Robal Road.	Highway 20	Highway 97	Minor Arterial
Empire Ave.	O.B. Riley Road	Highway 20	Minor Arterial
NE 18th St.	Cooley Road	Empire Ave.	Minor Arterial
Boyd Acres Road	Empire Ave.	Butler Market Road	Minor Arterial
Mt. Washington Drive	Century Drive	Highway 20	Minor Arterial
Butler Market Road	Highway 20	East MPO boundary	Minor Arterial
NE 8th St.	Butler Market Road	NE 9th St.	Minor Arterial
NE 9th St.	NE 8th St.	Reed Market Road	Minor Arterial
NE 15th St.	Highway 20	Knott Road	Minor Arterial
Knott Road	Highway 97	SE 27th St.	Minor Arterial
SE 27th St.	Knott Road	Reed Market Road	Minor Arterial
Neff Road	NE 8th St.	East MPO Boundary	Minor Arterial
Olney Ave.	NE 8th St.	Wall St.	Minor Arterial
Revere Ave.	Hill St.	NE 8th St.	Minor Arterial
Division St.	Highway 20	Revere Ave.	Minor Arterial
Bear Creek Road	NE 10th St.	East City Limits	Minor Arterial
Franklin Ave.	NE 10th St	Wall St.	Minor Arterial
Galveston Ave.	Riverside Drive	NW 17th St.	Minor Arterial
Riverside Drive	Wall St.	Galveston Ave.	Minor Arterial
Skyliners Road	NW 17th St.	West MPO Boundary	Minor Arterial
Greenwood Ave.	Wall St.	NE 3Road St.	Minor Arterial
Shelvin Park Road	Newport Ave.	West MPO Boundary	Minor Arterial
Newport Ave.	Shelvin Park Road	Wall St.	Minor Arterial
Brookwood Blvd.	Baker Road	Reed Market Road	Minor Arterial
Baker Road	Highway 97	Brookwood Blvd.	Minor Arterial
Simpson Ave.	Simpson Ave.	Colorado Ave.	Minor Arterial
NE 14th St.	Newport Ave.	Simpson Ave.	Minor Arterial
Colorado	Mt. Washington Drive	Scott St.	Minor Arterial
Arizona Ave.	Colorado Ave.	Colorado Ave.	Minor Arterial

Roadway	From	To	Classification
Wall St.	Franklin Ave.	Hill St.	Minor Arterial
Hill St.	Wall St.	Revere St.	Minor Arterial
Bond St.	Franklin Ave.	Wall St.	Minor Arterial
NE 4th St.	Franklin Ave.	Butler Market Road	Minor Arterial
Wilson Ave.	SE 3Road St.	Bond St.	Minor Arterial
Bond St.	Reed Market Road	Wilson Ave.	Minor Arterial
Century Drive	Reed Market Road	West MPO Boundary	Minor Arterial
Wells Acres Road	Butler Market Road	NE 27th St.	Major Collector
Pettigrew Road	Reed Market Road	Bear Creek Road	Major Collector
Purcell Blvd.	Bear Creek Road	Yeoman Road	Major Collector
Yeoman Road	East City Limits	Deschutes Market Road	Major Collector
Brinson Blvd.	Boyd Acres Road	Butler Market Road	Major Collector
NE 18th St.	Empire Ave.	Brinson Blvd.	Major Collector
Stevens Road	SE 27th St.	East MPO Boundary	Major Collector
Ward Road	Stevens Road	Hamby Road	Major Collector
Hamby Road	Ward Road	Butler Market Road	Major Collector
Ferguson Road	SE 27th St.	SE 15th St.	Major Collector
NE 4th St.	Franklin Ave.	Glenwood Drive	Major Collector
Glenwood Drive	NE 4th St.	SE 9th St.	Major Collector
Wilson Ave.	SE 3Road St.	SE 15th St.	Major Collector
American Lane	Reed Market Road	Brosterhous Road	Major Collector
Brosterhous Road	SE 3Road St.	Knott Road	Major Collector
Murphy Road	Brosterhous Road	NW 3Road St.	Major Collector
Country Club Road	Knott Road	Murphy Road	Major Collector
Parrell Road	China Hat Road	Brosterhous Road	Major Collector
China Hat Road	Knott Road	Highway 97	Major Collector
Ponderosa Drive	Highway 97	Lodgepole Drive	Major Collector
Lodgepole Drive	Ponderosa Drive	Brookwood Blvd.	Major Collector
Archie Briggs Road	Mt. Washington Drive	O.B. Riley Road	Major Collector
O.B. Riley Road	Highway 20	North MPO Boundary	Major Collector
Summit Drive	Mt. Washington Drive	Mt. Washington Drive	Major Collector
NW 12th St.	Summit Drive	NW 9th St.	Major Collector
NW 9th St.	NW 12th St.	Newport Ave.	Major Collector
Putnam Road	Mt. Washington Drive	North MPO Boundary	Major Collector
Awbrey Road	Mt. Washington Drive	Newport Ave.	Major Collector
Portland Ave.	Wall St.	College Way	Major Collector
College Way	Newport Ave.	Saginaw Ave.	Major Collector
Powers Road	Brookwood Blvd.	Parrell Road	Major Collector
Chase Road	Parrell Road	Brosterhous Road	Major Collector

Roadway	From	To	Classification
Bond St.	Wilson Ave.	Franklin Ave.	Major Collector
Wall St.	Industrial Way	Franklin Ave.	Major Collector
Hawthorne Ave.	NE 4th St.	Oregon Ave.	Major Collector
Hawthorne Ave.	Wall St.	Highway 97	Major Collector
Oregon Ave.	Hawthorne Ave.	Wall St.	Major Collector
Studio Road	NE 4th St.	Butler Market Road	Major Collector
Northwest Crossing Drive	West MPO Boundary	Shelvin Park Road	Major Collector
Lemhi Pass Road	Skyliners Road	Northwest Crossing Drive	Major Collector
Deschutes Market Road	Butler Market Road	North MPO Boundary	Major Collector
Brentwood Road	Brosterhous Road	American Lane	Major Collector
Metolious Drive	Mt. Washington Drive	West MPO Boundary	Major Collector
Skyline Ranch Road	West MPO Boundary	North MPO Boundary	Major Collector
SE 2 nd Ave	Scott St.	Wilson Ave.	Major Collector
Beall Road	NE 27th St.	Hamby Road	Major Collector

Deschutes County Classification

Baker Road	Zuni Road	Brookwood Blvd	Rural Collector
Baker Road	Highway 97	Brookwood Blvd	Rural Arterial
Brookwood Blvd.	Baker Road	South City UGB	Rural Arterial
China Hat Road	Knott Road	South MPO boundary	Forest Highway
Knott Road	Highway 97	China Hat Road	Rural Arterial
Skyliners Road	West City UGB	West MPO boundary	Rural Collector
Yeoman Road	18th St	Deschutes Market Road	Rural Collector
Deschutes Market Road	Butler Market Road	Hamehook Road	Rural Collector
Butler Market Road	East City UGB	East MPO Boundary	Rural Arterial
Neff Road	East City UGB	East MPO boundary	Rural Arterial
Bear Creek Road	East City UGB	East MPO boundary	Rural Collector
Stevens Road	East City UGB	East MPO boundary	Rural Collector
Ward Road	Stevens Road	Highway 20	Rural Collector
Ward Road	Stevens Road	East MPO boundary	Rural Collector
Bear Creek Road	Ward Road	East MPO boundary	Rural Collector
Hamby Road	Highway 20	Butler Market Road	Rural Collector
Cinder Butte Road	Baker Road	Minnetonka Lane	Rural Collector
Minnetonka Lane	Cinder Butte Road	Kiowa Road	Rural Collector
Kiowa Road	Minnetonka Lane	Riverwoods Drive	Rural Collector
Riverwoods Drive	Kiowa Road	Choctaw Road	Rural Collector
Choctaw Road	Riverwoods Drive	Pima Road	Rural Collector
Pima Road	Choctaw Road	Zuni Road	Rural Collector

<i>Roadway</i>	<i>From</i>	<i>To</i>	<i>Classification</i>
Zuni Road	Pima Road	Baker Road	Rural Collector
ODOT Classification			
Highway 97	North MPO Boundary	South MPO Boundary	Statewide Expressway
Highway 20	North MPO Boundary	Highway 20/Highway 97 north junction	Statewide Expressway
Highway 20	Highway 20/Highway 97 north junction	NE 12th St.	Statewide Highway
Highway 20	NE 12th St.	East MPO Boundary	Statewide Expressway

Intersection Level of Service and Volume/Capacity Ratios

<i>Intersection</i>	<i>Level of Service</i>	<i>Delay (sec./veh)</i>	<i>Volume / Capacity</i>
Unsignalized Intersections			
ODOT Jurisdiction			
Highway 20/Cooley Road	E/A	47.5	0.19
Highway 20/Hamby Road	C/A	22.4	0.26
Highway 97 southbound Ramp/Empire Avenue	E/B	41.6	0.40
Highway 97 southbound Ramp/Butler Market Road	*	*	*
Highway 97 northbound Ramp/Butler Market Road	*	*	*
Highway 97 northbound Ramp/Colorado Avenue	*	*	*
Highway 97 northbound Ramp/Reed Market Road	F/A	53.7	0.39
Highway 97/Badger Road	*	*	*
Highway 97/Ponderosa Road – China Hat Road	F/B	>100	0.88
Highway 97 northbound Ramp/Baker Road	*	*	*
Highway 97 southbound Ramp/Baker Road	*	*	*
Bend Jurisdiction			
Empire Avenue/Boyd Acres Road (all-way stop)	F	>100	>1.00
Empire Avenue/18th Street	F/B	>100	>1.00
Ferguson Road/27th Street	B/A	13.1	0.08
Rickard Road/27th Street	B/A	12.7	0.12
Reed Market Road/9th Street	E/A	40.1	0.46
Reed Market Road/American Lane	F/B	>100	>1.00
Knott Road/15th Street	*	*	*
Knott Road/China Hat Road	C/A	17.9	0.44
Brookwood Boulevard/Baker Road	B/A	12.7	0.11
Neff Road/Hamby Road	B/A	14.5	0.27
Butler Market Road/Hamby Road	*	*	*
Butler Market Road/Hamehook Road	A/A	5.4	0.44
Brookwood Boulevard/Powers Road	C/A	18.0	0.29
Deschutes Market Road/Hamehook Road	B/A	10.1	0.15
Roundabout			
Bend Jurisdiction			
Reed Market Road/Mount Washington Drive	A	4.8	0.38
Reed Market Road/Brookwood Boulevard	C	19.2	0.94
Mount Washington Drive/Shelvin Park Road	A	4.9	0.31
Colorado Avenue – Century Drive/14th Street	A	4.8	0.38
Newport Avenue/14th Street	A	7.1	0.58
Galveston Avenue/14th Street	A	7.2	0.57
Colorado Avenue/Simpson Avenue	A	5.2	0.44

Intersection	Level of Service	Delay (sec./veh)	Volume / Capacity
Simpson Avenue/14th Street	A	5.8	0.43
Mount Washington Drive/Skyliners	A	3.9	0.25
Butler Market Road/8th Street	A	7.8	0.62
Signalized Intersections			
ODOT Jurisdiction			
Highway 20/Robal Road	B	11.2	0.51
Highway 20/Empire Avenue	C	28.7	0.73
Highway 20/Butler Market Road – Mount Washington Drive	C	28.4	0.58
Highway 20/Greenwood Avenue	D	51.8	0.93
Highway 20/8th Street	C	33.8	0.63
Highway 20/15th Street	*	*	*
Highway 20/27th Street	D	43.9	0.85
Highway 20/Revere Avenue	*	*	*
Highway 20/Olney Avenue	C	28.6	0.72
Highway 97/Cooley Road	C	25.1	0.86
Highway 97/Robal Road	C	22.6	0.73
Highway 97 northbound Ramp/Empire Avenue	C	24.4	0.71
Highway 97 southbound Ramp/Revere Avenue	*	*	*
Highway 97 northbound Ramp - Division/Revere Avenue	B	16.0	0.41
Highway 97 southbound Ramp/Colorado Avenue	*	*	*
Highway 97 southbound Ramp/Reed Market Road	C	21.1	0.67
Highway 97/Powers Road	B	19.3	0.67
Highway 97/Pinebrook Boulevard	*	*	*
Highway 97/3Road Street	*	*	*
Bend Jurisdiction			
3Road Street/Reed Market Road	D	47.4	0.90
3Road Street/Wilson Avenue	C	33.7	0.72
3Road Street/Franklin Avenue	C	34.4	0.70
3Road Street/Powers Road	B	19.6	0.56
3Road Street/Murphy Road	C	25.2	0.32
Butler Market Road/27 th Street	C	25.7	0.62
27th Street/Neff Road	E	69.5	>1.00
Reed Market Road/27th Street	B	18.8	0.42
Reed Market Road/15th Street	D	45.0	0.89
Portland Avenue – Olney Avenue/Wall Street	D	37.5	0.85
Olney Avenue – Neff Road/8th Street	D	43.3	0.88

<i>Intersection</i>	<i>Level of Service</i>	<i>Delay (sec./veh)</i>	<i>Volume / Capacity</i>
Notes:			
Unsignalized Intersections: A/A = Minor Street turn LOS/Major street turn LOS V/C = Individual lane groups Delay = Individual lane groups Roundabouts: V/C = Individual approach Delay = Individual approach Signalized and All-Way Stop Intersections: Delay = Average vehicle delay in the peak hour for entire intersection in seconds. * = Turn movement counts to be available in the near future			

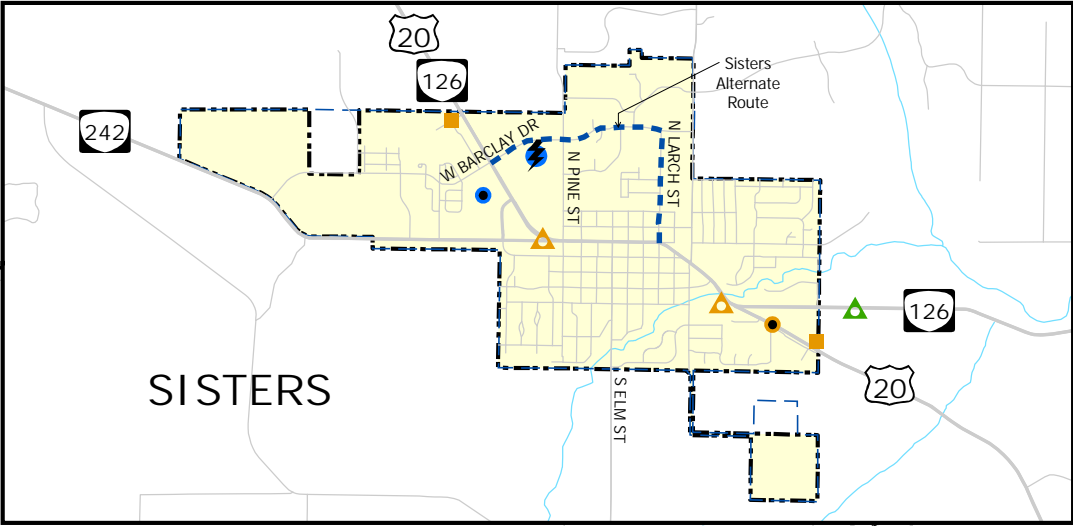
APPENDIX D

Land Use Data

Land Use Appendix to be completed at a later date

APPENDIX E

Deschutes County ITS Plan Project Map



Legend

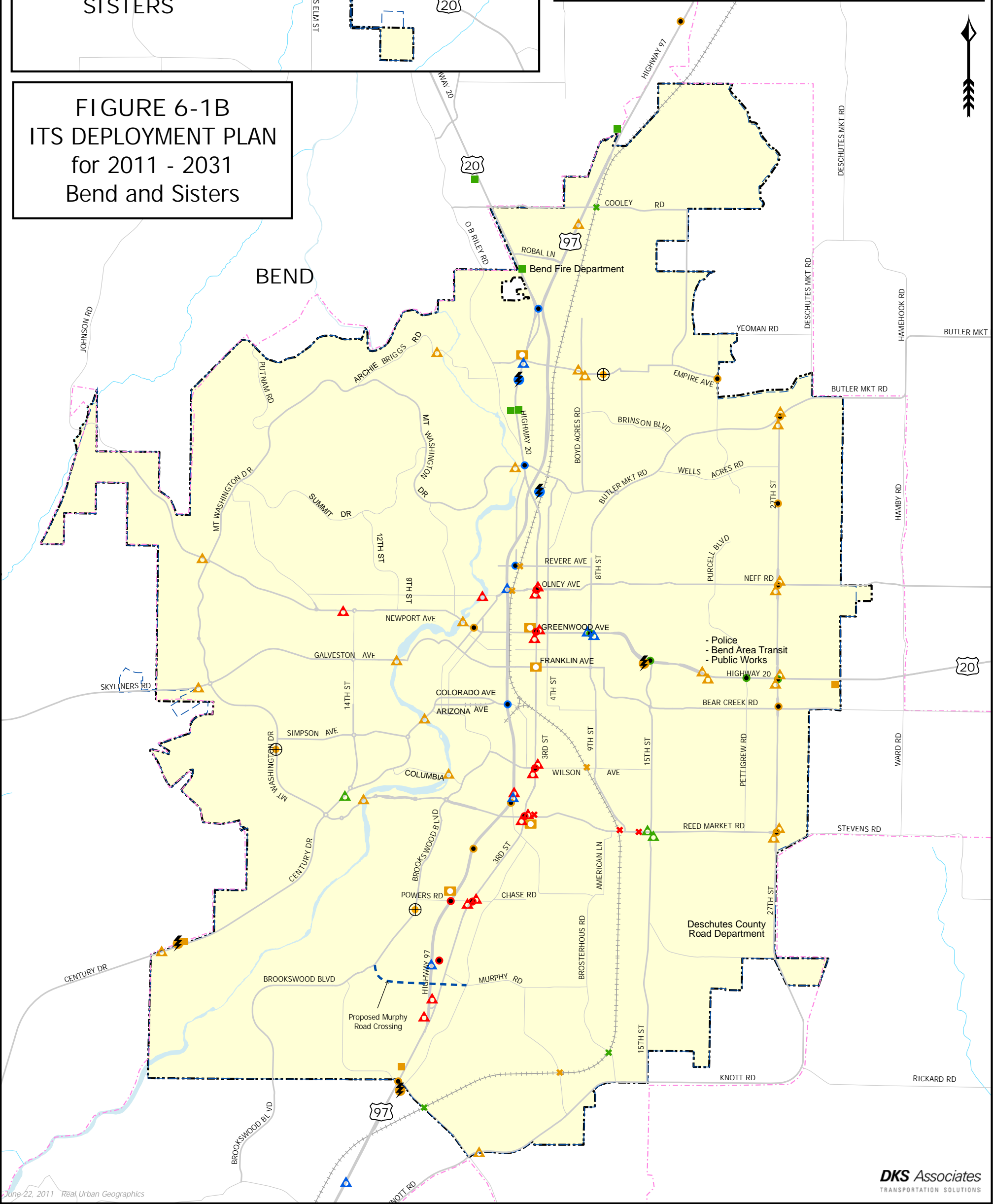
--- Bend MPO Boundary

DEVICE PHASING

- Existing
- Proposed High Priority
- Proposed Medium Priority
- Proposed Low Priority

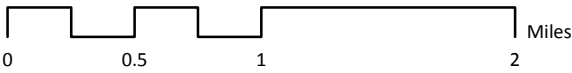
- CCTV Camera
- Variable Message Sign
- Weather Station
- Count Station
- Advanced Rail Warning System
- Variable Speed Limit Sign
- Speed Photo Enforcement
- Red Light Camera

FIGURE 6-1B
ITS DEPLOYMENT PLAN
for 2011 - 2031
Bend and Sisters



June 22, 2011 Real Urban Geographics

DKS Associates
TRANSPORTATION SOLUTIONS



APPENDIX F

Environmental Considerations

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Appendix F-1: MAP-21

The following are the Metropolitan Transportation Plan environmental-related elements in the MAP-21 legislation.

PUBLIC LAW 112–141—July 6, 2014

MOVING AHEAD FOR PROGRESS IN THE 21ST CENTURY ACT.

§ 1201. Metropolitan transportation planning

(i) **DEVELOPMENT OF TRANSPORTATION PLAN.—**

(2) **TRANSPORTATION PLAN.** — A transportation plan under this section shall be in a form that the Secretary determines to be appropriate and shall contain, at a minimum, the following:

(D) **MITIGATION ACTIVITIES.—**

(i) **IN GENERAL.** — A long-range transportation plan shall include a discussion of types of potential environmental mitigation activities and potential areas to carry out these activities, including activities that may have the greatest potential to restore and maintain the environmental functions affected by the plan.

(ii) **CONSULTATION.** — The discussion shall be developed in consultation with Federal, State, and tribal wildlife, land management, and regulatory agencies.

(5) **CONSULTATION.—**

(A) **IN GENERAL.—**In each metropolitan area, the metropolitan planning organization shall consult, as appropriate, with State and local agencies responsible for land use management, natural resources, environmental protection, conservation, and historic preservation concerning the development of a long-range transportation plan.

(B) **ISSUES.** — The consultation shall involve, as appropriate—

(i) comparison of transportation plans with State conservation plans or maps, if available; or

(ii) comparison of transportation plans to inventories of natural or historic resources, if available.

Appendix F-2: CETAS Meeting Minutes

CETAS Draft Technical Meeting Notes

May 15, 2007

Flanders Building – Room 228
123 NW Flanders, Portland

Members (in attendance):

Hal Gard, ODOT	Susan Haupt, ODOT	Michelle Eraut, FHWA
Yvonne Vallette, EPA	Charlotte Kucera, NMFS	David Leal, USFWS
Joyce Cohen, ODOT	Eric Metz, DSL	Michael Turaski, USACE
Corey Saxon, DEQ	Mollie Manion, SHPO	Art Marin, ODFW

Guests:

Rod Thompson, ODOT	Dan Ferke, ODOT	Tim Burkhardt, CH2MHILL
Susan Whitney, ODOT	John Raasch, ODOT	Mike Baker, ODOT
John Wiebke, DEA	Jerry Marmon, ODOT	Barbara Fraser, ODOT
Greg Holthoff, ODOT	Patti Caswell, ODOT	Claire Carder, ODOT
Tyler Deke, Bend MPO	Darcy McNamara, Consultant	Emily Moshofsky, ODOT
Ron Weinman, Clackamas County	Larry Conrad, Clackamas County	Linda Wannamaker, Wannamaker Consulting
Kay Van Sickle, Otak	Isaac Sanders, ODFW	

Meeting Facilitator: Susan Haupt, ODOT

Note Taker: Donette Miranda, HDR

Excerpt from minutes:

Agenda Item: Bend MPO Long-Range Plan Consultation

Lead: Tyler Deke, Bend MPO

Handouts:

General Data, PowerPoint Presentation, Draft Environmental Considerations Chapter Report Structure, and Maps

Notes:

Tyler Deke (Bend MPO) gave an overview of the Bend area.

Historic

- Native American encampments along Deschutes River
- High desert vegetation
- US Forest Service and National Monument land

- City of Bend incorporated in 1904

Current

- Low density urban
- Small farms and ranches

Bend MPO

- Second smallest in the state
- Member Agencies
 - City of Bend
 - Deschutes County
 - ODOT

David asked if the City of Redmond will be added at some point. Tyler stated that Redmond would not meet the population density criteria, but could under the Deschutes County designation. Bend is currently undergoing a major UGB expansion. The MPO boundary will need to expand to accommodate.

A TSP is not adopted. The area is not within an air quality nonattainment area, plan updates are required every five years. The plan will be adopted then revised to reflect the Bend UGB expansion. The expansion will impact which projects have funding.

There has been a lot of data collection and map development. Now analysis and impact discussion is occurring.

The product is map based. Each section will have a summary, methodology, findings, and mitigation options.

Bend:

- High desert
- Deschutes River
- Cascades
- Rain/snow precipitation

The community visioning process has been completed. There are site specific documents and plans. Used bend UGB study area as the study area boundary.

Utilities will be added to the zoning map if possible.

An NPDES permit was obtained in January. Stormwater was discharged directly into the Deschutes and underground with little or no treatment. Drainage is becoming a big issue. Impervious surface areas are being calculated. TMDLS are due in 2008, so they will not be included in this planning project. Any retrofits will have to comply with the new standards. The potential for hazardous material issues is significant. Could have major groundwater contamination. Data points are from an original set that has not been ground truthed and is not very accurate. The second is from a set that is being ground truthed and is accurate.

The drill holes do not contribute too much to the Deschutes baseflow. Stormwater may have an impact, but how much is unknown. Stormwater is going to a shallow aquifer on top of the drinking water.

Portions of the Deschutes is 303(d) listed for temperature, pH, DO, and chlorophyll A. The main reason is due to flow regime. The Deschutes has five irrigation diversions. Flow is low from April to October, which is when the issues occur, particularly temperature issues. Tumalo Creek is to the northwest. About 30 to 40 percent of the households are on septic (approximately 8,000 to 12,000 households). There are plans to get households on sewer.

Irrigation service areas do not service all areas. Canals are dry from October to April. There are four dams and five diversions in the area. Diversions started construction in 1901. The city was incorporated in 1904. In 1906 fish were plentiful. In 1912 hatcheries were being built to replenish the fisheries. Dams were in place by 1920. Fish passage is spotty. One dam is 35 feet tall with no fish ladder and there is not great fish ladder potential. One diversion has a good fish screen. All have some element to prevent fish from getting into the canals, but with varying degrees of success.

Bull trout were historically present, but not currently. Native redband trout are present and brook trout and brown trout have been introduced. Art stated that Steelhead Falls precludes anadromous fish migration. He suggested the team use Streamnet data. David stated that there is bull trout critical habitat. Data can be obtained from the USFWS website. Art stated that there is no EFH there.

There are no upland wetlands. All wetlands are associated with the river and riparian areas. NWI data was used for the county as LWI data was not available. Areas of special interest include rock outcroppings under Goal 5 and rivers of special interest. Buffers vary from 30 to 100 feet. The deer and elk range is from the county. They tend to not enter the city. The Open Space Conservation zone has air and water regulations and unique qualities. Bull trout and eagle are the two species with recovery plans. Spotted frog is in the county, as are bats and sage grouse. There may be lamprey and mussels.

There are no known listed plant species in the MPO. There are a lot of invasive species. David suggested they double check the eagle databases. Nesting sites are pretty well mapped out.

Approximately half the drinking water is from wells that are 300 feet or more deep. There are well protection areas. Water reallocation is being discussed in terms of drinking water capacity for anticipated future population. The bigger issue is outside of Bend. There is an issue in Prineville. Canals are now being lined to prevent leakage. There are three water providers in the city.

Fire evacuation routes are a serious issue. Access routes cannot be limited too much for fire evacuation. There are aggregate mines in the MPO area.

There have been attempts at filtration systems to filter stormwater. Soils in the area are very porous and water shoots through. Mazama ash is in the soil. Filtration ponds have been built on some impervious soils and ended up filling with stagnant waters and not draining. 75 percent of the deep aquifer is from snowmelt. There is interest in mapping the change in snow pack.

Air quality issues are from wood burning stoves and agricultural fires. The DEQ website showed that the area exceeded PM10 on one day last year, which did not trigger a designation. There is interest in additional monitoring throughout the region. Car testing is not required. There are wood burning stove regulations in Bend and standards have to be met. Wood burning stoves are rarely put in new construction. The area has minor inversion layers.

Scenic resources include the byway, state and federal waterways, and upland and water landscape management areas, which regulate scenic views.

There are two historic sensitivity areas, two historic districts downtown. SHPO will be contacted on a case by case basis. The Klamath, Burns Paiute, and Warm Springs tribes have been contacted.

There are parks, trails, parks 4(f), historic 6(f), refuges 4(f), and boat ramps 4(f) in the area. Susan stated that she can help the MPO determine which resources are 4(f) and 6(f).

The MPO has EJ layers, but not here. There are low-income populations, but they are not sure about minority populations yet.

A detailed analysis of how projects overlay on resources has not yet been done. A draft project map has been completed. The project list is fairly in alignment with the Bend and Deschutes TSPs. The only new projects are the connection between 27th and Empire, Murphy Road extension, and an access road into the Gopher Gulch area. There is interest in extending the road from Century Road up to Highway 20. Land use changes at the north end of the MPO will impact transportation systems. There will also be changes at the south end of the MPO, which will segment projects. The city is following the state's UGB process for expansion. Issues are coming down to transportation access and sanitary sewer. Sanitary sewer will dominate.

Initial findings include potential impact areas. Wildlife crossings will be a bigger issue if the MPO expands. Stormwater costs are not being estimated right now. There is a lot of discussion around cost estimates. A consultant has been hired. There are huge discrepancies in cost estimates.

The MPO is moving forward to collect additional data. Not all data is readily available or may be difficult to get it. Applying recovery plans on a localized basis can be challenging. The MPO does not have good data about where species on lists are

located or if they exist in or adjacent to the study area. Environmental resources have not been addressed at this level in the past, but more on a project or regional level.

Questions/Comments:

Charlotte stated that it appears no NMFS species are in this area due to upstream dams, which is unique among MPOs. She suggested that the MPO state that in the documentation. Eric said that there is local interest in reestablishing steelhead. Art said that steelhead will not be able to access this area. Yvonne asked if there was an LWI for Bend. Darcy McNamara (Consultant) said Bend does, but there are not any wetlands *[note: actual statement should be that there are no wetlands other than the identified wetlands in the riparian zone of the Deschutes River. There are identified NWI wetlands in the County (outside the city limits, but it is doubtful they are actually wetlands and are most likely mapping artifacts - dm.)]* Michelle said that it would be helpful to include transportation projects, by phase, on some of the maps. Tyler said that they plan to by the final submission. Michelle mentioned that the public comment period will be open if resource agencies are interested. Tyler said that the MPO efforts are on the city website. The intention is to have a draft done by the first week of June and the comment period in June. Adoption will occur in late June, which will only meet federal requirements, not state requirements. Michelle stated that it was insightful to consider the UGB expansion and buffer. Tyler said it came to light when considering large mammal range issues. A lot of the UGB expansion area will be designated as urban reserve. Michelle said that an illustrative list might be beneficial to include on some of the maps. Barbara asked what the timeline was for the other part of the planning process. Tyler stated that the goal is to have the state compliance plan done by the end of the fiscal year. They have compiled a lot of data. It is a matter of how to package it and what it implies. May not do anything with the state compliance plan until the UGB expansion is finalized.

Appendix F-3: Federally Listed Species and Migratory Birds of Concern in Deschutes County

There are a total of 9 federally listed threatened, endangered, or candidate species in Deschutes County (Table F-3-1). Species on this list would be considered in an effects analysis for future transportation projects. The effects analysis could include species that exist in another geographic area.

Table F-3-1: Federally Listed Threatened, Endangered, and Proposed Candidate Species Which May Occur within Deschutes County, Oregon

Species	Status
Amphibians	
Oregon Spotted Frog (<i>Rana pretiosa</i>)	Threatened
Birds	
Greater sage-grouse (<i>Centrocercus urophasianus</i>)	Candidate
Northern Spotted owl (<i>Strix occidentalis caurina</i>)	Threatened
Yellow-Billed Cuckoo (<i>Coccyzus americanus</i>)	Proposed Threatened
Conifers and Cycads	
Whitebark pine (<i>Pinus albicaulis</i>)	Candidate
Fishes	
Bull Trout (<i>Salvelinus confluentus</i>)	Threatened
Oregon chub (<i>Oregonichthys crameri</i>)	Threatened
Mammals	
Fisher (<i>Martes pennanti</i>)	Candidate
Gray wolf (<i>Canis lupus</i>)	Endangered

Source: U.S. Fish and Wildlife Service Information, Planning and Conservation System (IPAC) Trust Resources List. Accessed July 30, 2014.

Table F-3-2 identifies the critical habitats that are within Deschutes County. The Oregon Spotted frog critical habitat is within the BMPO. Proposed critical habitat for the Oregon spotted frog is within the BMPO – extending along the Deschutes River from the western BMPO boundary to the Colorado Avenue bridge.

Table F-3-2: Critical Habitats within Deschutes County

Species	Critical Habitat Type
Oregon Spotted frog (<i>Rana pretiosa</i>)	Proposed
Northern Spotted owl (<i>Strix occidentalis caurina</i>)	Final designated
Bull Trout (<i>Salvelinus confluentus</i>)	Final designated

Source: U.S. Fish and Wildlife Service Information, Planning and Conservation System (IPAC) Trust Resources List. Accessed July 30, 2014.

There are 10 migratory birds of concern in Deschutes County (Table F-3-3).

Table F-3-3: Migratory Birds of Concern

Species Name	Seasonal Occurrence in Project Area
Brewer's Sparrow (<i>Spizella breweri</i>)	Breeding
Calliope Hummingbird (<i>Stellula calliope</i>)	Breeding
Cassin's Finch (<i>Carpodacus cassinii</i>)	Year-round
Least Bittern (<i>Ixobrychus exilis</i>)	Breeding
Olive-Sided flycatcher (<i>Contopus cooperi</i>)	Breeding
Pinyon Jay (<i>Gymnorhinus cyanocephalus</i>)	Year-round
Purple Finch (<i>Carpodacus purpureus</i>)	Year-round, Wintering
Rufous hummingbird (<i>selasphorus rufus</i>)	Breeding
Williamson's Sapsucker (<i>Sphyrapicus thyroideus</i>)	Breeding
Willow Flycatcher (<i>Empidonax traillii</i>)	Breeding

Source: U.S. Fish and Wildlife Service Information, Planning and Conservation System (IPAC) Trust Resources List. Accessed July 30, 2014.

Appendix F-4: Rare, Threatened, and Endangered Species in Deschutes County

Scientific Name	Common Name	Global Rank*	State Rank*	Federal Status*	State Status*	ORBIC List*
VERTEBRATES						
<i>Ambystoma mavortium melanostictum</i>	Blotched tiger salamander	G5T4	S2?			3
<i>Anaxyrus boreas</i>	Western toad	G4	S4		SV	4
<i>Aneides ferreus</i>	Clouded salamander	G3G4	S3S4		SV	4
<i>Ascaphus truei</i>	Coastal tailed frog	G4	S3	SOC	SV	4
<i>Batrachoseps wrighti</i>	Oregon slender salamander	G3	S3	SOC	SV	4
<i>Rana cascadae</i>	Cascades frog	G3G4	S3S4	SOC	SV	4
<i>Rana pretiosa</i>	Oregon spotted frog	G2	S2	T	SC	1
<i>Accipiter gentilis</i>	Northern goshawk	G5	S3S4	SOC	SV	4
<i>Aechmophorus occidentalis</i>	Western grebe	G5	S3B,S2S3N			4
<i>Aegolius funereus</i>	Boreal owl	G5	S3?			3
<i>Amphispiza bilineata</i>	Black-throated sparrow	G5	S3B			4
<i>Aquila chrysaetos</i>	Golden eagle	G5	S3			4
<i>Artemisiospiza belli</i>	Sage sparrow	G5	S4B		SC	4
<i>Asio flammeus</i>	Short-eared owl	G5	S3			3
<i>Athene cunicularia hypugaea</i>	Western burrowing owl	G4T4	S3B	SOC	SC/SV	4
<i>Bucephala albeola</i>	Bufflehead	G5	S2B,S5N			2
<i>Bucephala islandica</i>	Barrow's goldeneye	G5	S3B,S3N			4
<i>Buteo regalis</i>	Ferruginous hawk	G4	S3B	SOC	SC/SV	4
<i>Buteo swainsoni</i>	Swainson's hawk	G5	S3B		SV	4
<i>Centrocercus urophasianus</i>	Greater sage-grouse	G3G4	S3	C	SV	2
<i>Chlidonias niger</i>	Black tern	G4	S3B	SOC		4
<i>Chordeiles minor</i>	Common nighthawk	G5	S5B		SC	4
<i>Coccyzus americanus</i>	Yellow-billed cuckoo	G5	SHB	C	SC	2-ex
<i>Contopus cooperi</i>	Olive-sided flycatcher	G4	S2S3B	SOC	SV	4
<i>Dryocopus pileatus</i>	Pileated woodpecker	G5	S4		SV	4
<i>Empidonax traillii adastus</i>	Willow flycatcher	G5T5	S3B	SOC	SV	4
<i>Falco peregrinus anatum</i>	American peregrine falcon	G4T4	S2B		SV	2

Scientific Name	Common Name	Global Rank*	State Rank*	Federal Status*	State Status*	ORBIC List*
<i>Falco peregrinus tundrius</i>	Arctic peregrine falcon	G4T3	SNR		SV	2
<i>Grus canadensis tabida</i>	Greater sandhill crane	G5T4	S3S4B		SV	4
<i>Haliaeetus leucocephalus</i>	Bald eagle	G5	S4B,S4N		SV	4
<i>Icteria virens</i>	Yellow-breasted chat	G5	S4B	SOC	SC	4
<i>Lanius ludovicianus</i>	Loggerhead shrike	G4	S3B,S2N		SV	4
<i>Melanerpes lewis</i>	Lewis's woodpecker	G4	S2B,S2?N	SOC	SC	2
<i>Numenius americanus</i>	Long-billed curlew	G5	S3B		SV	4
<i>Oreortyx pictus</i>	Mountain quail	G5	S3S4	SOC	SV	4
<i>Oreoscoptes montanus</i>	Sage thrasher	G5	S3S4B			4
<i>Otus flammeolus</i>	Flammulated owl	G4	S3B		SV	4
<i>Picoides albolarvatus</i>	White-headed woodpecker	G4	S2	SOC	SC	2
<i>Picoides arcticus</i>	Black-backed woodpecker	G5	S3		SV	4
<i>Picoides dorsalis</i>	American three-toed woodpecker	G5	S3		SV	4
<i>Pinicola enucleator</i>	Pine grosbeak	G5	S2?			3
<i>Regulus satrapa</i>	Golden-crowned kinglet	G5	S3			4
<i>Sialia mexicana</i>	Western bluebird	G5	S4B,S4N		SV	4
<i>Spizella breweri</i>	Brewer's sparrow	G5	S3B			4
<i>Sterna forsteri</i>	Forster's tern	G5	S3B			4
<i>Strix nebulosa</i>	Great gray owl	G5	S3		SV	4
<i>Strix occidentalis caurina</i>	Northern spotted owl	G3T3	S3	LT	LT	1
<i>Sturnella neglecta</i>	Western meadowlark	G5	S4		SC	4
<i>Tympanuchus phasianellus columbianus</i>	Columbian sharp-tailed grouse	G4T3	S1	SOC	SC	2
<i>Oncorhynchus mykiss gairdneri</i>	Inland Columbia Basin redband trout	G5T4	S3	SOC	SV	4
<i>Salvelinus confluentus</i> pop. 14	Bull trout (Odell Lake SMU)	G4T2Q	S2	LT	SC	1
<i>Salvelinus confluentus</i> pop. 17	Bull trout (Willamette SMU)	G4T2Q	S2	LT	SC	1
<i>Salvelinus confluentus</i> pop. 18	Bull trout (Deschutes SMU)	G4T2T3	S2S3	LT	SV	1
<i>Brachylagus idahoensis</i>	Pygmy rabbit	G4	S2?	SOC	SV	2
<i>Canis lupus</i>	Gray wolf	G4G5	S1S2	PS:LE	LE	2
<i>Corynorhinus townsendii</i>	Townsend's big-eared bat	G3G4	S2	SOC	SC	2
<i>Euderma maculatum</i>	Spotted bat	G4	S2	SOC	SV	2

Scientific Name	Common Name	Global Rank*	State Rank*	Federal Status*	State Status*	ORBIC List*
<i>Gulo gulo</i>	Wolverine	G4	S1	PT	LT	2
<i>Lasionycteris noctivagans</i>	Silver-haired bat	G5	S3S4	SOC	SV	4
<i>Lasiurus cinereus</i>	Hoary bat	G5	S3		SV	4
<i>Lepus californicus</i>	Black-tailed jack rabbit	G5	S4		SV	4
<i>Lepus townsendii</i>	White-tailed jackrabbit	G5	S4?		SV	3
<i>Lynx canadensis</i>	Canada lynx	G5	S1?	LT		2
<i>Martes caurina</i> pop. 1	Pacific Marten - Interior Population	G4G5T4T5	S3S4		SV	4
<i>Myotis evotis</i>	Long-eared myotis	G5	S4	SOC		4
<i>Myotis volans</i>	Long-legged myotis	G5	S3	SOC	SV	4
<i>Myotis yumanensis</i>	Yuma myotis	G5	S3	SOC		4
<i>Ovis canadensis nelsoni</i>	Desert bighorn sheep	G4T4	SX			2-ex
<i>Pekania pennanti</i>	Fisher	G5	S2	PS:C	SC	2
<i>Sciurus griseus</i>	Western gray squirrel	G5	S4		SV	4
<i>Sorex preblei</i>	Preble's shrew	G4	S3?	SOC		3
<i>Ursus arctos horribilis</i>	Grizzly bear	G4T3T4	SX	LT		2-ex
<i>Vulpes macrotis</i>	Kit fox	G4	S1		LT	2
<i>Vulpes vulpes necator</i>	Sierra Nevada red fox	G5T1T2	S1			1
<i>Crotalus oreganus</i>	Western rattlesnake	G5	S5		SC	4
<i>Sceloporus graciosus graciosus</i>	Northern sagebrush lizard	G5T5	S5	SOC	SV	4
INVERTEBRATES						
<i>Anodonta californiensis</i>	California floater (mussel)	G3Q	S2	SOC		2
<i>Gonidea angulata</i>	Western ridged mussel	G3	S2S3			2
<i>Margaritifera falcata</i>	Western pearlshell	G4G5	S4			4
<i>Juga hemphilli</i> ssp. 1	Indian Ford juga (snail)	G2T1	S1			1
<i>Pristiloma crateris</i>	Crater Lake tightcoil (snail)	G2	S2			1
<i>Pristiloma wascoense</i>	Shiny tightcoil (snail)	G3	S2			2
<i>Sixeonotus</i> sp. 1	A plant bug	G2	S1?			3
<i>Calliopsis barri</i>	A miner bee	GNR	S1			2
<i>Perdita accepta</i>	A miner bee	GNR	S1?			1
<i>Rhyacophila chandleri</i>	A caddisfly	G3	S3			2
<i>Rhyacophila kincaidi</i>	A caddisfly	G4G5	S1S2			3
<i>Rhyacophila rickeri</i>	A caddisfly	G3G4	S1S2			3
NON-VASCULAR PLANTS						

Scientific Name	Common Name	Global Rank*	State Rank*	Federal Status*	State Status*	ORBIC List*
Harpanthus flotovianus	Liverwort	G5	S1			2
Jungermannia polaris	Liverwort	G4	S1			2
Nardia japonica	Liverwort	G5	S2			2
Rivulariella gemmipara	Liverwort	G2	S2			1
Bruchia bolanderi	Moss	G3	S2			3
Buxbaumia aphylla	Moss	G4G5	S3			3
Conostomum tetragonum	Moss	G5	S1			2
Helodium blandowii	Moss	G5	S3			4
Schistidium heterophyllum	Moss	G3G4	SNR			3
Tomentypnum nitens	Moss	G5	S3			4
Calicium abietinum	Lichen	G4G5	S3			4
Cladidium bolanderi	Lichen	G4	S1			2
Stenocybe major	Lichen	G4	S3			4
Usnea lambii	Lichen	G4G5	S1			3
Alpova alexsmithii	Fungus	G2	S2			1
Brauniellula albipes	Fungus	G3	S1			3
Chrysomphalina grossula	Fungus	G3G4	S1?			3
Cortinarius wiebeae	Fungus	G2	S2			3
Elaphomyces subviscidus	Fungus	G2G3	S1S2			3
Fevansia aurantiaca	Fungus	G1	S1			3
Gamundia leucophylla	Fungus	G3?	S1			3
Gastroboletus ruber	Fungus	G3	S3			3
Gautieria magnicellaris	Fungus	G5?	S1			3
Helvella crassitunicata	Fungus	G3	S2			2
Hydnotrya inordinata	Fungus	G2	S2			3
Polyozellus multiplex	Fungus	G4G5	S3			4
Pseudorhizina californica	Fungus	G4	S2			2
Rhizopogon atroviolaceus	Fungus	G2G3	S2S3			3
Rhizopogon flavofibrillosus	Fungus	G2G3	S2			3
Rhizopogon semireticulatus	Fungus	G2G3	S2			3
Rhizopogon subpurpurascens	Fungus	G2G3	S2			3
VASCULAR PLANTS						
Agoseris elata	Tall agoseris	G4	S1			2
Allium bisceptrum	Two-stemmed onion	G4G5	S4			4
Arnica viscosa	Shasta arnica	G4	S2			2

Scientific Name	Common Name	Global Rank*	State Rank*	Federal Status*	State Status*	ORBIC List*
<i>Artemisia ludoviciana</i> ssp. <i>estesii</i>	Estes' artemisia	G5T3	S3	SOC		4
<i>Astragalus lemmonii</i>	Lemmon's milk-vetch	G2	S1			1
<i>Astragalus misellus</i> var. <i>misellus</i>	Pauper milk-vetch	G4T2?	S2?			1
<i>Astragalus peckii</i>	Peck's milk-vetch	G3	S3		LT	1
<i>Botrychium pumicola</i>	Pumice grape-fern	G3	S3		LT	1
<i>Callitriche fassettii</i>	Fassett's water-starwort	G1Q	SNR			3
<i>Camissonia pusilla</i>	Washoe suncup	G3G4	S2			2
<i>Carex bebbii</i>	Bebb's sedge	G5	S4			4
<i>Carex capitata</i>	Capitate sedge	G5	S2			2
<i>Carex diandra</i>	Lesser panicled sedge	G5	S1			2
<i>Carex lasiocarpa</i> var. <i>americana</i>	Slender sedge	G5T5	S2			2
<i>Castilleja chlorotica</i>	Green-tinged paintbrush	G3	S3			1
<i>Castilleja rupicola</i>	Cliff paintbrush	G3G4	S3	SOC		4
<i>Chamerion latifolium</i>	Broad-leaved willow-herb	G5	S3			4
<i>Collomia larsenii</i>	Talus collomia	G4	S4			4
<i>Cypripedium montanum</i>	Mountain lady's-slipper	G4	S3S4			4
<i>Douglasia laevigata</i>	Smooth-leaved douglasia	G3	SNR			3
<i>Draba aureola</i>	Golden alpine draba	G4	S4			4
<i>Elatine brachysperma</i>	Short-seeded waterwort	G5	S1			2
<i>Elmera racemosa</i> var. <i>racemosa</i>	Yellow coralbells	G4G5T4	S4			4
<i>Elodea nuttallii</i>	Nuttall's waterweed	G5	SNR			3
<i>Epilobium luteum</i>	Yellow willow-herb	G5	S3			4
<i>Erigeron cascadenis</i>	Cascade daisy	G4	S4			4
<i>Gentiana newberryi</i> var. <i>newberryi</i>	Newberry's gentian	G4T3T4	S2			2
<i>Hieracium horridum</i>	Shaggy hawkweed	G4	S1			2
<i>Hierochloa odorata</i>	Holy grass	G5	S3			4
<i>Lilaea scilloides</i>	Flowering quillwort	G5?	S3?			4
<i>Limosella acaulis</i>	Owyhee mudwort	G5	SNR			3
<i>Lycopodium annotinum</i>	Stiff clubmoss	G5	S3			4
<i>Mimulus jepsonii</i>	Jepson's monkeyflower	G4	S3			4
<i>Myriophyllum sibiricum</i>	Common water-milfoil	G5	S3			4
<i>Nama densum</i> var.	Compact fiddleleaf	G5T5	SNR			3

Scientific Name	Common Name	Global Rank*	State Rank*	Federal Status*	State Status*	ORBIC List*
<i>parviflorum</i>						
<i>Penstemon peckii</i>	Peck's penstemon	G3	S3	SOC		1
<i>Pilularia americana</i>	American pillwort	G5	S2			2
<i>Pinus albicaulis</i>	Whitebark pine	G3G4	S3?	C		4
<i>Poa lettermanii</i>	Letterman's bluegrass	G4	SNR			3
<i>Poa stenantha</i>	Narrow-flower bluegrass	G5	SNR			3
<i>Poa suksdorfii</i>	Suksdorf's bluegrass	G4	SNR			3
<i>Polystichum kruckebergii</i>	Kruckeberg's sword-fern	G4	S4			4
<i>Potamogeton berchtoldii</i>	Slender pondweed	G5	S3?			4
<i>Pyrola dentata</i>	Toothleaf pyrola	G4	S2?			2
<i>Scheuchzeria palustris</i> ssp. <i>americana</i>	Scheuchzeria	G5T5	S2			2
<i>Silene suksdorfii</i>	Suksdorf's campion	G4	S4			4
<i>Smelowskia ovalis</i> var. <i>ovalis</i>	Shortfruited smelowskia	G5T4	S4			4
<i>Spartina pectinata</i>	Prairie cordgrass	G5	SNR			3
<i>Sphenopholis obtusata</i>	Prairie wedgegrass	G5	SNR			3
<i>Stuckenia filiformis</i> ssp. <i>alpina</i>	Northern slender-leaved pondweed	G5T5	SNR			3
<i>Stuckenia filiformis</i> ssp. <i>occidentalis</i>	Western slender-leaved pondweed	G5T5	S3			4
<i>Thelypodium howellii</i> ssp. <i>howellii</i>	Howell's thelypody	G2T2	S1	SOC		1

* For a description of the code, see: <http://orbic.pdx.edu/documents/2013-codes.pdf>

Source: Oregon Biodiversity Information Center 2013 Rare, Threatened, and Endangered Species in Oregon List. Accessed August 6, 2014.

Appendix F-5: Deschutes County Weed List

Deschutes County Weed Policy and Classification System

“NOXIOUS WEED” means any weed designated by the Deschutes County Board of Commissioners that is injurious to public health, agriculture, range, recreation, wildlife, or any public or private property; any weed that impacts and displaces desirable vegetation, such as Threatened and Endangered Plant Species, wildlife habitat, and livestock.

It is acknowledged that certain noxious weeds have become so thoroughly established and are spreading so rapidly on state, county, and federally owned lands, as well as on private land, that they may have been declared by Oregon Revised Statute 570.505 to be a menace to public welfare. Steps leading to eradication where possible, are necessary. It is further recognized that the responsibility for such eradication and/or intensive control rests not only on the private landowner and operator, but also the county, state and federal government.

Noxious Weed Control Rating System

Noxious Weeds, for the purpose of this system, shall be designated “A”, “B” or “C”

1. An “A” designated weed is: a priority noxious weed designated by the Deschutes Weed Board as a target weed species on which the Weed Control District will comply with a state wide management plan and/or implement a county wide plan for intensive control and monitoring. An “A” rated weed may also be a weed of known economic or ecological importance which occurs in small enough infestations to make eradication/containment possible; or one that is not known to occur here, but its presence in neighboring counties make future occurrence here seem imminent.

Recommended Action: Infestations are subject to intensive control when and where found.

2. A “B” designated weed is: a weed of economic importance, which is both locally abundant and abundant in neighboring counties.

Recommended Action: Moderate control and or monitoring at the county level.

3. A “C” designated weed is: a weed that has the potential to cause harm to agriculture production and transportation systems.

Recommended Action: Control and monitoring at the county level.

“A” Rated Weeds

African Rue

Buffalobur +

Common Houndstongue

Dyer’s Woad **

Peganum harmala

Solanum rostratum

Cynoglossum officinale

Isatis tinctoria

Eurasian Milfio +
 False Brome
 Giant Cane (Giant Reed)
 Hydrilla
 Leafy Spurge +
 Meadow Knapweed
 Mediterranean Sage +
 Medusahead Rye +
 Musk Thistle **
 Orange Hawkweed +
 Perennial Pepperweed +
 Purple Loosestrife +
 Rush Skeletonweed
 Russian Knapweed +
 Saltcedar Tamarix +
 Scotch Thistle +
 Squarrose Knapweed
 Sulfur Cinquefoil
 Tansy Ragwort +
 Ventenata +
 Whitetop; Hoary Cress +
 Wild Carrot +
 Yellow Floating Heart
 Yellow Starthistle **

“B” Rated Weeds

Canada Thistle +
 Dalmation Toadflax +
 Diffuse Knapweed +
 Kochia (annual) +
 Myrtle Spurge +
 Poison Hemlock +
 Puncturevine +
 Ribbon Grass +
 Russian Thistle +
 Scotch Broom
 Spotted Knapweed +
 Yellow Toadflax or “Butter and Eggs” +
 Yellowflag Iris +

“C” Rated Weeds

Bur Buttercup +
 Bull Thistle +
 Cheat Grass (Downy brome) +
 Common Mullein +
 Dodder +

Myriophyllum spicatum
 Brachypodium sylvaticum
 Arundo donax
 Hydrilla verticillata
 Euphorbia esula
 Centaurea pratensis
 Salvia aethiopis
 Taeniatherum caputmedusae
 Carduus nutans
 Hieracium aurantiacum
 Lepidium latifolium
 Lythrum salicaria
 Chondrilla juncea
 Acroptilon repens
 Tamarix ramosissima
 Onopordum acanthium
 Centaurea virgata
 Potentilla recta
 Senecio jacobaea
 Ventenata dubia
 Lepidium draba
 Daucus carota
 Nymphoides peltata
 Centaurea solstitialis

Cirsium arvense
 Linaria dalmatica
 Centaurea diffusa
 Kochia scoparia
 Euphorbia myrsinites
 Conium maculatum
 Tribulus terrestris
 Phalaris arundinacea var. picta
 Salsola spp.
 Cytisus scoparius
 Centaurea biedersteinii
 Linaria vulgaris
 Iris pseudacorus

Ranunculus testiculatus
 Cirsium vulgare
 Bromus tectorum
 Verbascum thapsus
 Cuscuta spp.

Field Bindweed +	Convolvulus arvensis
Filaree Redstem +	Erodium cicutarium
Horseweed +	Conyza Canadensis
Poverty Sumpweed +	Iva axillaries
Quackgrass +	Agropyron repens
Reed Canary Grass +	Phalaris arundinacea
South American Waterweed +	Elodea densa
Spiny Cocklebur +	Xanthium spinosum
St Johnswort +	Hypericum perforatum
Sweet Clover(s) -Only on Right of Ways +	Melilotus officinalis
Western Water-Hemlock / +	Cicuta douglasii+

+ Currently in the County

**** All known populations have been treated**

/ Natives but Poisonous to Animals or Humans

Appendix F-6: Individually Listed Properties on the National Register of Historic Places

Name of Property	Year Built	Address
Drake Park Historic District	1910	District
Old Town Historic District	Various	District
Emil & Ottilie Wienecke House	1924	1325 NW Federal Street
Jonathan N B Gerking House	1906	66725 Gerking Market Road
United States Post Office (Old)	1932	745 NW Wall Street
Bend Amateur Athletic Club Gymnasium	1917	520 NW Wall Street
Bend High School (Old)	1925	520 NW Wall Street
Boyd, Charles, Ranch House, Bunk House, Ice House	1905	20410 Rivermall Avenue
Congress Apartments	1924	221, 223, 225, 227, 229 NW Congress Street
Peter Byberg House	1916	153 NW Jefferson Place
Deschutes County Library	1938	507 NW Wall Street
Downing Building	1920	1033-1035 NW Bond Street
Hope-Van Allen House	1927	352 NW Drake Road
Simpson E. Jones House	1924	1535 NW Awbrey Road
Thomas McCann House	1915	440 NW Congress Street
Robert Moore House	1921	545 NW Congress Street
O'Kane Building	1916	115 NW Oregon Avenue
New Taggart Hotel	1911	215 NW Greenwood Avenue
George Palmer Putnam and Dorothy Binney House	1911	606 NW Congress Street
Reid School	1914	460 NW Wall Street
Evan Andreas Sather House	1911	7 NW Tumalo Avenue
N. P. (Nicholas Paul). Smith Pioneer Hardware	1909	935-937 Wall Street
B. A. (Byron A."Dutch" and Ruth) Stover House	1924	1 NW Rocklyn Road
Trinity Episcopal Church	1929	469 NW Wall Street

Source: Oregon State Historic Preservation Office: <http://heritagedata.prd.state.or.us/historic/>

Appendix F-7: Historic Designations

City of Bend Historic and Cultural Resources Designated by the City Council

<u>File Number</u>	<u>Historic Site / Name</u>	<u>Address</u>	<u>Tax Map Number</u>
1848 TL/08700	1813 Rock <i>in museum</i>	129 NW Idaho Ave.	17-12-32CA
126 TL/05100	Drake, A.M. Lodge <i>demolished</i>	Drake Park	17-12-32BD
44 TL/08600	Bend Athletic Club Gym* <i>1901</i>	520 NW Wall St.	17-12-32CA
10 TL/00132	Oregon Trunk Railroad Passenger Depot <i>1918</i>	313 Shevlin-Hixon Drive	18-12-0500
22 TL/07100	Bend School Landmark <i>1911 moved</i>	Drake Park	17-12-32BD
18 TL/01500	Bend Water & Light Co. Powerhouse and Dam <i>1877 demolished</i>	Foot of Vermont St.	17-12-32AC
25 TL/03200	Bend Woolen Mill <i>1909</i>	1854 NE Division St.	17-12-29DD
24 TL/05100	Central Oregon Pioneers Landmark <i>1923</i>	Pioneer Park	17-12-32AB
118 TL/07300	Downing Hotel and Café* <i>1923</i>	1033 NW Bond St.	17-12-32AC
20	First Presbyterian Church* <i>1920 listed on the National Register of Historic Places in November 2004</i>	157 NW Franklin Ave.	17-12-32DB TL/11001
39 TL/01800	Foley Landmark <i>Land donated in 1928 to public in his honor</i>	Pilot Butte State Park	17-12-34
113 TL/00200	French, A. L. House * <i>1912</i>	429 NW Georgia	17-12-32CD
267 TL/04400	Hoovers Universal Garage <i>1912</i>	124-128 NW Greenwood	17-12-32AC
23 TL/07100	Johns Landmark <i>1915</i>	Drake Park	17-12-32BD
	<i>1928 drowning</i>		

109	Kenwood School	701 NW Newport Ave.	17-12-32BC
TL/04900	1920		
119	Liberty Theater*	849 NW Wall St.	17-12-32BD
TL/06200	1917		
115	Lucas, A. C. House	42 NW Hawthorne Ave.	17-12-32DA
TL/01800	1910 (<i>first brick house in Bend</i>)		
125	Steidl and Tweet Dam	Division St. near Yale Ave.	17-12-29AD
TL/04300	(DCMID Irrigation Dam)		
	1912		
272	McCann, Thomas House*	440 NW Congress St.	17-12-32CB
TL/03200	1915		
120	Trinity Episcopal Church*	469 NW Wall St.	17-12-32CA
TL/04000	1929		
281	Niswonger, C. P. House	44 NW Irving	17-12-32AD
TL/04800	1910		
19	O'Kane Building*	115 NW Oregon Ave.	17-12-32AC
TL/06200	1916		
11	Oregon Trunk Freight Warehouse Site	Division St.	17-12-32AD
TL/05000	1912 <i>demolished</i>		
121	Putnam, George Palmer House*	606 NW Congress St.	17-12-32CA
TL/02900	1911		
288	Pilot Butte Inn Site*	1133 NW Wall St.	17-12-32AC
TL/01400	1902, 1903, 1916 <i>demolished June 15, 1973</i>		
13	Tucker, A. J. Blacksmith Shop	200-202 NW Greenwood	17-12-32AC
TL/02700	1919		
102	Reed, James E. House	45 NW Greeley Ave.	17-12-32DA
TL/05300	1904		
21	Reid School*	129 NW Idaho Ave.	17-12-32CA
TL/08700	1914		
135	St. Francis Catholic Church*	494 NW Lava Rd.	17-12-32DB
TL/11900	1920 (<i>2001 NRHP</i>)		
16	Shevlin Hixon Mill Site*	Shevlin Center	18-12-
05BB TL/00300	1915 <i>demolished</i>		
123	Smith, N. P. Hardware Store *	935-937 NW Wall St.	17-12-32BD
TL/06800	1910		

93	U.S. Post Office*	777 NW Wall St.	17-12-32CA
TL/08300	1932		
90	Weist Home Site Landmark	1315 NE 3rd St.	17-12-33BB
TL/06400	1914, <i>demolished</i>		
12	West, John I. Building	130 NW Greenwood Ave.	17-12-32AC
TL/04300	1911		
14	Wright Hotel*	215 NW Greenwood Ave.	17-12-32AC
TL/07700	1911, <i>partially demolished in 1989</i>		
	Adopted August 17, 1988		
	Resolution 1857		
110	Sawyer, Robert House	434 Drake Rd.	17-12-32BC
TL/01000	1913		
103	Sather, Evan A. House*	7 NW Tumalo	17-12-32CB
TL/12900	1911		
116	Allen, Herbert E. House*	875 Brooks St.	17-12-32BD
TL/04900	1904 (<i>Oldest house in Bend. Officially named the Goodwillie, Allen-Rademacher house</i>)		
	Adopted April 17, 1991		
	Resolution 1963		
280	Nelson, August Building	838 NW Bond St.	17-12-32DB
TL/03700	1916		
133	Cozy Hotel	327 NW Greenwood	17-12-32AC
TL/07500	1917		
15	Brooks-Scanlon Office	15 SW Colorado Ave	18-12-05BB
TL/00200	Building Site (Lumberman's Hospital)		
	1919 <i>demolished in 1987 to make way for new office building</i>		
17	Brooks-Scanlon Crane Shed	721 SW Industrial Way	18-12-05BA
TL/00600	1937 <i>demolished illegally on August 19, 2004</i>		
249	Brooks-Scanlon Mill "A" Sawmill	805 SW Industrial Way	18-12-05BA
TL/00400	1915 (Removed from resource list by City Council in 2006.)		
124	Boyd, Charles Homestead*	20410 Bend River Mall	17-12-21C
TL/00902	1905-1909 <i>moved to make way for Bend River Mall</i>		
	Revised March 3, 1993		
	Bend Area General Plan		
247	Old Bend High School*	520 NW Wall St.	17-12-32CA
TL/08600			

	1914		
269	Keyes, John P. House*	912 NW Riverside Blvd	17-12-32CA
TL/02600			
	1912		
276	Mountain View (Mayne) Hospital*	515 NW Kansas Ave.	17-12-32CB
TL/01900			
	1919		
291	Moore, Robert D. House*	545 NW Congress St.	17-12-32CB
TL/02700			
	(Shevlin-Hixon Exec. House)		
	1921		
294	Stover, Ruth and Dutch A. House*	1 NW Rocklyn Road	17-12-32BD
TL/03200			
	1927		
260	Deschutes County Library*	507 NW Wall St.	17-12-32CA
TL/08500			
	1938		
	Adopted March 3, 1993		
	Resolution 2057		
101	Delaware Grocery*	845 NW Delaware	17-12-32CD
TL/13000			
	1923		
98	Bend Clinic	731 NW Franklin Ave.	17-12-32CA
TL/01300			
	1924		
107	O'Donnel Building	933 NW Wall St.	17-12-32BD
TL/06700			
	1912		
111	Pierson, Pete Blacksmith Shop	211 NW Greenwood	17-12-32AC
TL/08700			
	1923	(at the corner of Harriman)	
122	Spheir, D. H. Building	901 NW Bond St	17-12-32AC TL/05700
	1917	(at the corner of Minnesota)	
	Adopted January 15, 1992		
	Resolution 2001		
No #	Nels and Lillian Andersen House	63160 Nels Anderson Rd	17-12-21B0
	Adopted July 15, 2009		
	Ordinance NS-2123		

* Property is also listed on the National Register of Historic Places

Appendix F-8: Properties Funded with Land and Water Conservation Fund Grants

Grant Title	Grant Sponsor	Amount	Date Approved
Columbia Park Development	City of Bend	\$5,792.50	11/3/1966
Columbia Park Development #2	City of Bend	\$5,525	12/5/1968
Columbia Park Development Phase 3	City of Bend	\$4,800	11/17/1969
Dutch Stover Park	City of Bend	\$3,750	6/25/1970
Dutch Stover Park Development	City of Bend	\$4,925	10/27/1970
Dutch Stover Park, Phase 2	City of Bend	\$7,970	12/8/1971
Bend Swimming Pool Rehabilitation	City of Bend	\$39,128	5/5/1972
Vince Genna Stadium Lights	City of Bend	\$18,695.67	7/16/1973
Juniper Park Tennis Courts & Landscaping	City of Bend	\$36,000	1/24/1975
Mirror Pond Acquisition	City of Bend	\$59,854	5/23/1974
Shevlin Park Water System	City of Bend	\$7,404.84	6/26/1974
Ponderosa Park Picnic Area	Bend Park and Recreation District	\$17,104.72	6/23/1977
Juniper Park Covered Pool	Bend Park and Recreation District	\$737,338.82	1/17/1978
Skyline Park Development, Phase 1	Bend Park and Recreation District	\$93,710.84	8/24/1978
Hollinshead Acquisition Development	Bend Park and Recreation District	\$90,365	1/26/1984
Kiwanis Park Development	Bend Park and Recreation District	\$47,666.83	12/4/1984
Hillside Park Phase 2	Bend Park and Recreation District	\$15,967.25	4/26/1990
Sawyer Park Bridge Access & Safety Improvements	Bend Park and Recreation District	\$102,500	8/22/2003

Source: United States Department of the Interior, National Park Service, Land & Water Conservation Fund: Detailed Listing of Grants Grouped by County. Available at: <http://waso-lwcf.nrcr.nps.gov/public/index.cfm>. Accessed July 30, 2014. Properties within the BMPO boundary only.

Appendix F-9: Metadata for Maps

Compiled by: Jude Fulghum, City of Bend, Engineering/GIS Department

Layers Included on All Maps:

The following layers are included on all maps. These layers were created locally in 2007, either by the City of Bend or Deschutes County GIS departments under the direction of planning staff for the initial development of the Environmental Considerations chapter of the Bend Metropolitan Transportation Plan.

- Bend City Limits
- Study Area Boundary
- Arterial/Collector Roads- Bend has many roundabouts located on arterial and collector streets which are shown as circles
- State Highways
- Deschutes River

The layer, MPO Boundary, found on all maps was given to the City by the Oregon Department of Transportation (ODOT).

The Deschutes County GIS department also created several other layers present on many of the maps:

- Streams
- Railroad
- Canals

Metadata applicable to specific map layers includes:

Map 1: Relief Map: Hillshade relief layer supplied by Deschutes County GIS department. This file was created in 1998.

Map 2: Zoning: Zoning layer created and updated by Deschutes County GIS department. City of Bend information derived from City Zoning Ordinance.

Map 3: Utilities:

- Pressure and gravity sewer line data was obtained from the City of Bend and represents those lines 10" in diameter or larger.
- Water line information was obtained from the City of Bend and shows those lines 8" in diameter or larger.
- Gravity interceptor information was provided to the City of Bend by an outside consultant working on the development of the City's Sewer Master Plan.

- Avion water lines were obtained from Avion Water in May 2006, and include lines with 8" diameter or greater.

Map 4: Stormwater:

- River drainage layer drawn by City of Bend GIS staff based on catch basin system with flow to the Deschutes River. See notes below regarding the accuracy of catch basin data.
- City of Bend stormwater data only provided for locations for which the City is responsible for maintaining (i.e., structures found on private property are not included). Accuracy of drill hole, drywell, and catchbasin layers based on the following:
 - All locations prior to May 2003 were entered by hand, based on flat maps updated by City of Bend street department,
 - All locations between May 2003 and April 2005 were determined by GPS position, with accuracy of approximately 1 meter, and typically only reflects new construction,
 - All locations after April 2005 were determined by GPS position, with accuracy of approximately 1 inch, and typically only reflects new construction (or occasional update of existing data).
- Deschutes County stormwater data was obtained from the Deschutes County GIS department and shows locations on County owned properties within the study boundary. Classifications of feature types are slightly different from the City's. The City obtains a GPS feature for each type; the County has one feature that may include more than one type. Please see the legend of this map for symbology.

Map 5: Water Quality:

- The top five (5) drainage problem areas were identified as part of the City of Bend Master Plan workshop in January, 2007.
- The DEQ 2002 303(d) streams GIS coverage was obtained from the Department of Environmental Quality (DEQ) and reflects 2002 data. According to DEQ, the list includes data submitted by individuals, organizations and government agencies as well as DEQ's own monitoring information.
- Subbasin information was generated for the City of Bend by MWH, a private consulting firm, contracted to develop the City's Sewer Master Plan. Subbasin information is reflected as of September 14, 2005.

Map 6: Environmental Health:

- Information regarding the location of the wells was obtained from the Deschutes County GIS department and represents the Public Water System groundwater well, infiltration gallery, and spring locations used for drinking water. The layer includes Department of Environmental Quality (DEQ) and Oregon Department of Human Services' (DHS) Drinking Water Program Source Water Assessment results for systems active in June 1999.
- Location of service stations was obtained using Deschutes County GIS department layers, and was based on a query through the County's factor book

(property class and stat class codes) which describes improvements on Deschutes County properties. The query singled out all properties identified as commercial automotive Service Stations, but may be incomplete.

- Well protection area information was obtained from the Department of Environmental Quality (DEQ) in 2005 and may have inaccuracies based on lack of groundtruthing of well locations.
- Avion Water District boundary obtained from GIS department at Avion Water.
- Roats boundary drawn based on flat map information provided by Roats Water.
- City of Bend boundary based on remainder of area within City's city limits.

Map 7: Irrigation Service Areas: Sources for GIS layers for boundary lines for the four irrigation districts affected by the study are listed below. Note that irrigation boundaries may overlap each other as some districts serve customers of other districts.

- Central Oregon Irrigation District (COID): obtained directly from the District's GIS department,
- Arnold Irrigation District: obtained from Geo-Spatial Solutions, a GIS consulting firm located in Bend, Oregon specializing in water resource issues,
- Swalley and Tumalo Irrigation Districts: obtained from the Deschutes County GIS department and verified as current by Geo-Spatial Solutions.

Map 8: Fish Passage:

- Source for the information on bridges in the study area was derived from the National Bridge Inventory System which was supplied to the Deschutes County GIS department by the Oregon Department of Transportation (ODOT).
- Dam and diversion locations verified by the City of Bend.

Map 9: Natural Resource Protection Areas:

- Approved Waterway Overlay Zone (WOZ) and Upland and River Areas of Special Interest (ASI) layers for the City of Bend were originally created by the Deschutes County GIS department based on formal ordinances approved by the City of Bend's City Council.
- County ASI data was obtained from the Deschutes County GIS department.
- City Significant Goal 5 Wetlands were created in late 2000 as the result of a Riverway project grant. The GIS layers were created from maps drawn as the result of a wetland inventory conducted by an outside consultant as part of that grant.
- The NWI Wetlands layer was obtained from the Deschutes County GIS department, and reflects wetlands area location and classification as defined by the U.S. Fish & Wildlife Service.
- The Open Space Conservation and Wildlife Area layers were obtained from the Deschutes County GIS department and are compiled from their zoning ordinance.
- Eagle nest vicinity information supplied by the Oregon Department of Fish and Wildlife (ODFW) from the Isaacs and Anthony databases.

Map 10: Vegetation: The vegetation information was obtained from the Deschutes County GIS department and presents the current distribution of ecological systems (as defined by NatureServe, www.natureserve.org) in Deschutes County.

Map 11: Natural Hazards:

- The earthquake fault line was obtained from Deschutes County's GIS department.
- 100 foot contour line data was obtained from Deschutes County's GIS department (for areas outside of the City of Bend). 50 foot contour lines within the City of Bend were supplied by 3Di, a consulting firm hired by the City to fly an aerial view of the city limits and provide topographic information resulting from that flight (flown in April, 2005).
- Slope data was obtained from the Deschutes County GIS department and depict slopes with a 25% grade or greater.
- Surface mine and surface mining impact area information was obtained from the Deschutes County GIS department. The surface mine information is part of the zoning ordinance, and the impact area represents a half mile buffer around the surface mining zones.
- Fire history information was obtained from the Deschutes County GIS department and depicts historical wildfire locations in the study area from 1908 through 2006.
- FEMA 100 foot floodplain information was obtained from the Deschutes County GIS department and is based on Flood Insurance Rate Maps published by the Federal Emergency Management Agency (FEMA).

Map 12: Soil Conductivity: Hydrologic soil group information was obtained from the U.S. Department of Agriculture and, according to USDA, "represent estimates of runoff potential with soils being assigned to one of four groups according to the rate of water filtration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-term storms".

Map 13: Scenic Resources:

- The Federal Wild and Scenic Waterway and the Oregon Scenic Waterway layers were obtained from Deschutes County's GIS department and represent waterways designated as scenic by either the United States Congress or the Oregon legislature.
- The two County Landscape Management layers were also obtained from Deschutes County's GIS department and represent corridors identified in the Comprehensive Plan and Zoning maps as important to the maintenance of natural and scenic resources.
- The Cascade Lakes National Scenic Byway information was obtained from the Deschutes National Forest based on the road's selection in 1989 as a National Scenic Byway by Scenic America.

Map 14: Cultural Resource Protection:

- Historical designations identify properties with significant historical and cultural heritage values. Properties are identified as historic resources by the Deschutes County Landmark Commission and Bend City Council. Some historic resources shown are granted status through the National Register of Historic Places while others do not have the same level of protection granted through the National Register.
- The Central Oregon Heritage Group High Sensitivity Area information was obtained from the Bureau of Land Management.
- Craftsman style bungalow information was obtained through the Des Chutes Historical Center, and was prepared in November, 1999.

Map 15: Public Lands and Trails:

- The trail system layer was obtained from Deschutes GeoGraphics, an outside consultant hired by the City of Bend in 2006 to create an updated bike and trail system map. This layer was originally sent to the consultant on 8/3/05 by the Bend Park and Recreation District, but was modified in the process of creating the City's bike and ped plan. Some alignments were changed, but the majority of trail additions were included. This layer is displayed along with an additional layer updated and given to the City by the Bend Park and Recreation District in April, 2007.
- Park Area information consists of two GIS layers. "Other Parks" was obtained from the Deschutes County GIS department and includes parcel outlines of parks, state parks, city parks, rural parks, as well as campgrounds, trailheads, boat launches, and other features. Laid over this layer is "Bend Metro Parks" which is a GIS layer received from Bend Park and Recreation District in April, 2007.
- The remaining layers (County Land, Federal Land, State Land, Public Lands) associated with government owned land were obtained from the Deschutes County GIS department and are based on parcel ownership.

Map 16: Percent of Minority Households: Information regarding the percent of minority households was obtained from the Oregon Department of Transportation (ODOT), although ODOT did not create and does not maintain this GIS data. The original data was created by the Oregon Geospatial Enterprise Office (GEO) from Year 2000 census blockgroup boundaries, using US Census Bureau information. "Minority households" refers to non-White and White Hispanic persons.

Map 17: Percent of Low Income Households: Information regarding the percent of minority households was obtained from the Oregon Department of Transportation (ODOT), although ODOT did not create and does not maintain this GIS data. The original data was created by the Oregon Geospatial Enterprise Office (GEO) from Year 2000 census blockgroup boundaries, using US Census Bureau information. Data refers to the percent of persons in households with incomes below the poverty threshold, as defined by the US Environmental Protection Agency in the "National Guidance for Conducting Environmental Justice Analyses" document (1998).

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Appendix F-11: Maps

The following maps are based on data collected in 2007 for the initial development of the Environmental Considerations chapter of the Bend Metropolitan Transportation Plan.

Map 1: Relief Map
Map 2: Zoning
Map 3: Utilities
Map 4: Stormwater
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APPENDIX G

Plan Updates & Amendments

Plan Updates

As required by the code of federal regulations, the Metropolitan Transportation Plan (MTP) must be updated every five years. The scope and schedule of the MTP will be determined by the MPO committees and Policy Board in consultation with FHWA and FTA.

Metropolitan Transportation Plan Amendment Process

The Metropolitan Transportation Plan (MTP) establishes a comprehensive policy direction for the regional transportation system and recommends a balanced program of transportation investments to implement that policy direction. The MTP is updated every five years, as required by federal law. In between full updates to the MTP, it may be necessary to amend the plan in response to changing local conditions and newly adopted plans. To be eligible to build a project with federal funds the project must first be amended into the MTP.

The recommended investments in the MTP do not solve all transportation problems and are not intended to be the definitive capital improvement program on the local transportation system for the next 20 years. Rather, the MTP identifies the projects, programs or further refinement studies required to adequately meet regional transportation system needs during the planning period. Local conditions are addressed through city and county TSPs, and will require additional analysis and improvements to provide an adequate transportation system. The MTP anticipates such refinements. Refinements to the RTP may also result from ongoing corridor refinement plans, NEPA studies or other area studies.

Major Amendments

These are amendments that come from NEPA processes, Corridor Refinement Plans or other studies and involve additions or deletions of projects or a significant change in scope of the project location or function. The amendment will be accompanied by a demonstration of consistency with the MTP. The amount of information required to demonstrate consistency with the MTP shall be commensurate with the scope of the project.

The following process will be used for Major Amendments to the MTP:

- 1) Bend MPO Technical Advisory Committee (TAC) and Policy Board review of proposed amendments
- 2) 25-day public comment period
- 3) Staff compiles comment report and distributes to TAC and Policy Board
- 4) Bend MPO TAC review of comments and recommendation to Policy Board
- 5) Policy Board public hearing, deliberation and adoption

Minor Amendments

Other amendments resulting from local TSPs: new roadway, transit, bikeway, pedestrian, freight and demand management projects necessary to meet the objectives of the MTP shall be accompanied by an demonstration of consistency with the MTP.

The amount of information required to demonstrate consistency with the MTP shall be commensurate with the scope of the project.

The following process will be used for Minor Amendments to the MTP:

- 1) Bend MPO TAC review of proposed amendments and recommendation to Policy Board
- 2) Policy Board review of proposed amendments, receive public comment, deliberation and adoption

Operations, Maintenance and Safety Project Amendments

Operations, maintenance and safety improvements are deemed consistent with the policy intent of the MTP if (a) they are needed to serve the travel demand associated with the MPO area's adopted population and employment forecasts, and (b) they are consistent with affected jurisdictional plans.

Operations, Maintenance, and Safety Projects Amendments to the MTP will be reviewed by the Bend MPO TAC.

Modifications to the Illustrative Project List

A formal amendment process is not required for changes to projects that are included only for illustrative purposes.

Modifications to the Illustrative Project list will be reviewed by the Bend MPO TAC. The TAC will determine if the Policy Board should be consulted about the proposed changes.

Public Notification

Information about proposed amendments and ability for public review and comment will use one or more of the following methods: media releases, BMPO webpage, BMPO e-mail lists, and other communication methods and opportunities as appropriate.